ATLAS

OPHTHALMOSCOPY.

CONTAINING

THE NORMAL AND PATHOLOGICAL CONDITIONS

OF THE FUNDUS OCULI AS SEEN WITH THE OPHTHALMOSCOPE.

WITH

12 CHROMOLITHOGRAPHIC PLATES, CONTAINING 59 FIGURES.

BY

DR. R. LIEBREICH,

FOR THE FIRST TRANSLATED BY D. HARRISON GRANDY.

SECOND EDITION

LONDON:

J. & A. CHURCHILL, 7, GREAT MARLBOROUGH STREET.

1870.

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DRAWN FROM NATURE AND ACCOMPANIED BY AN EXPLANATORY TEXT,

BY

DR. R. LIEBREICH,

THE TEXT TRANSLATED BY H. ROSBOROUGH SWANZY.

SECOND EDITION

(ENLARGED AND REVISED).

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Preface to the Second Edition.

THE favourable reception accorded to this work, would have decided me to publish a second edition at once, upon the first becoming completely out of print, had it not been my intention to enlarge it by the addition of some new drawings. For this, however, I required time, and the more so as I did not wish to select the new additions from among my old originals, but desired to prepare sketches, specially for this purpose, from choice cases. In the selection of these I have not been influenced alone by what my own experience in teaching has shown me to be required, but I have also obtained the valuable advice of a great number of fellow-specialists.

It appeared very desirable to add drawings of choroiditis disseminata, recent retinitis hæmorrhagica, neuritis optici, partial atrophy of the optic disc secondary to retro-ocular affections of the nerve, atrophy of the papilla secondary to retinitis; of which diseases I had met with very characteristic cases; while, it is to be regretted, that I did not enjoy the opportunity of drawing other subjects, particularly tubercle of the choroid and intra-ocular tumours. The new drawings might have been given upon separate supplementary plates; this would, however, on the one hand, have considerably increased the price of the work, and on the other, would not have been suitable to the arrangement of the whole. I preferred, therefore, to make room for the new cases by omitting the less instructive drawings of some rarities. Thus a very typical representation of choroiditis disseminata, which required a large space, has been given instead of Figs. 2 and 3, Plate VI, and a case of retinitis hæmorrhagica in place of the much less useful cyanosis of the retina (Fig. 3, Plate IX.). Room for three new drawings has been gained by cutting off a little from Fig. 1, Plate XI, and thus the representation of the changes of the optic disc has been much advanced towards completion; Plate XI containing now 14 figures.

Plate I, representing the normal fundus oculi to the extreme boundaries of what is visible with a completely dilated pupil, was the one in which I had the greatest difficulties to overcome, and although with regard to its completeness it is unique among all hitherto known ophthalmoscopic and anatomical drawings, yet it appeared to me to be much less appreciated than the other plates. I explained this to myself by the fact that it was drawn in black, and that the network of lines gave it a diagrammatic appearance, while, in fact, it was as precise a portrait as the other figures of the Atlas. The lining is therefore omitted, and the plate is coloured. At the same time the enlargement has been reduced from twelve to ten diameters. Although I am convinced in general, that progress in ophthalmoscopic drawings is only to be made by increasing the enlargement, yet I have in this case exceptionally allowed an unimportant reduction in size; first, because the enlargement of 10 diameters has an advantage over one of 12, of making the estimation of the real size simple (one centimeter of the drawing corresponding to one millimeter of the real size); secondly, because by this means a

reduction in the size of the Atlas was made possible. Besides this change in size, the Atlas has been made more convenient by the separation of the German and French texts, and by the new arrangement of the text and plates.

Finally, considerable sacrifice has not been spared, in order, by reducing the price by nearly one-half, to make this work accessible to a larger circle of practitioners and students.

I trust, then, that this second edition will meet with the same favourable reception as its predecessor.

R. LIEBREICH.

Paris, *February*, 1870.

Preface to the First Edition.

I HAD the good fortune to be associated with our great physiologist Helmholtz as his assistant, when, in 1851, he invented the Ophthalmoscope in Königsberg, and thus I first became acquainted with it through the inventor himself. I soon afterwards in Berlin made the acquaintance of A. von Graefe, who was just then commencing his brilliant career. With him, and on his patients, I made the first practical applications of the new instrument.

The uncertainty with which, step by step, we advanced upon an unknown territory, soon showed the necessity of securing what had been won by means of drawings. Thus a comparison between new cases and those already observed became easy, and the results of autopsies became more valuable in explaining what had been seen with the Ophthalmoscope.

The first drawings suffered from an insufficient enlargement, for in the commencement the observations were made with the inverted image and a low power, whilst the erect image with its narrow field was seldom used, and only for examining the details. It soon, however, became evident to me that an examination by the inverted image with a high power is of the greatest importance; and, on the other hand, that certain differences in the illumination and mode of observation demand from us an equal cultivation of both methods.

From that time I could sketch larger portions of the fundus oculi, while I attended with great exactitude to the minute details; and thus in the course of years I produced quite a large collection of such drawings. These served me, in my lectures and practical demonstrations, for the explanation of cases which I had described or shown, or in order to supply the place of those cases of which an example was not at hand.

In now publishing this collection, after ten years' work, I comply with the wish long since expressed, of many of my professional brethren, for the first time; because, I waited that this branch of Ophthalmic science might attain a certain degree of completion and definement.

I have selected the most characteristic out of the great number of drawings which I have made, and upon twelve plates I have crowded fifty-seven of these together, in order to attain as much as possible with the least expense. For the same reason I have abandoned the circular shape of the drawings, which has until now been used. There are two cases in which this form must be chosen, namely, when only that portion of the fundus oculi is sketched which is seen at a single glance, and when it is drawn in its entire extent. The first is really the case in some of the drawings already published by others; the latter, however, has not been accomplished until now. Plate I. of this Atlas represents, for the first time, the fundus oculi drawn to its extreme periphery. This figure must, therefore, remain round. In the other drawings only the particular portion in question has been cut out in the most convenient shape, and thus it became possible, *e.g.*, upon Plate XI., to give eleven drawings of the optic disc, while, on the other hand, on Plate IV., Figs. 1 and 2, Plate IX., Fig. 1, more extensive changes in the fundus oculi are represented than until now has been the case.

By having taken part myself in the execution of the lithographs, an exact representation of the originals has been secured, and I have drawn the originals themselves from nature, carefully avoiding all idealizing or "schematising."

I publish these plates in the hope that they may be of use to the teachers of ophthalmoscopy in their demonstrations, and that they may be an aid in their studies to those who, with a small field for practical observation, wish to teach themselves. I trust, too, that they may be welcome to those medical men who, without any special interest in Ophthalmology, still desire to become acquainted with those affections of the internal membranes of the eye, which are connected with general diseases.

The text accordingly is so arranged that, to an explanation of the plates, it concisely unites what is most important for the comprehension of the chapter of Ophthalmoscopy in question. It appears simultaneously in German and French, in the hope that the work may obtain a kindly reception, as well in my own country, which I have left, as among my new colleagues here.

Paris, *January*, 1863.

CONTENTS.

PLATE I.

THE NORMAL FUNDUS OCULI.

DRAWN TO THE EXTREME LIMITS VISIBLE WITH PERFECTLY DILATED PUPIL.

LEFT EYE, INVERTED IMAGE.

(*Enlargement* = 10 *diameters*).

THE optic papilla is represented in the centre of the figure with its various boundaries. (1.) The darkly-pigmented choroidal boundary; (2.) The bright narrow curve of the sclerotic boundary; and lastly, (3.) The proper boundary of the nerve marked by a fine reddish-grey line.

The dark round spot to the left of the papilla represents the macula lutea, the bright spot in the centre is the foramen centrale, and the ring immediately around the latter is that region of the macula which in life appears yellowish, and hence somewhat redder than the surrounding neighbourhood.

The retinal vessels are seen emerging from the optic disc; the arteries are recognised by their yellowish reflection, and the veins by their darker colour. The vessels have been followed as far towards the periphery as was possible, the pupil being dilated *ad maximum*. On the inner half of the retina they are represented very nearly to the ora serrata; on the outer half (the left side of the figure), there is but a very small distance wanting to reach the anterior boundary of the retina; so that the vessels are here more extensively represented than in previous anatomical drawings.

Inasmuch as the enlargement is not greater than in most of the usual sketches, it will be easily seen from the picture how very small a portion of the fundus has been hitherto represented in ophthalmoscopic drawings. It might, indeed, be advisable to use this figure as a guide in descriptions and in future drawings.

In the first edition I furnished this figure with a network of lines, in the hope that it would be accepted as a basis for topographical determinations in ophthalmoscopic sketches and descriptions. As this proposal did not meet with much appreciation, I have, not without regret, omitted the network in this edition. The figure is reduced to 10 diameters, which will greatly simplify the determination of the enlargement of ophthalmoscopic pictures. The very analogous course which the retinal vessels take in different eyes, particularly towards the periphery, renders it admissible to accept such a drawing as a guide in judging of the size and position of other appearances and representations.

PLATE II.

INDIVIDUAL DIFFERENCES OF THE NORMAL FUNDUS OCULI.

HAVING in Plate I. seen the normal fundus oculi in its entire extent, we shall here consider the details, and in this plate particularly the different shades of colour of the fundus and the different shapes of the disc.

The very complicated vascular network of the choroid is embedded in a pigmented stroma, and covered in addition by a simple layer of pigmented epithelium. If the latter be dark in colour, it quite hides what lies behind. If the epithelium cells are, on the other hand, but slightly pigmented, the vessels of the choroid may be recognised, even to their finest ramifications, in case the stroma in which they lie be also weakly pigmented. When the stroma contains much pigment it hides the finer vessels, and forms dark interspaces in the coarser network of the large choroidal vessels.

Fig. 1 is taken from an individual with black hair and a very dark brown iris, and shows a very deep pigmentation both of the stroma and of the epithelium. Fig. 2, on the contrary, is taken from a very fair person with a blue iris, and, in consequence of the clear stroma and the still greater absence of pigment in the epithelium, it permits of the easy recognition of the choroidal vessels to their smallest ramifications. The branches of four different vortices are contained in the drawing. In the left lower corner of the figure they are followed nearly to a trunk, in the right upper corner not quite so far, while each of the two remaining corners only touches the margin of a vortex. In Fig. 3 the pigmentation of the stroma is extremely dark, that of the epithelium very weak; the larger vessels of the choroid appear, therefore, separated from one another by dark intervascular spaces; only in the neighbourhood of the posterior pole of the eye (to the right, and below in the figure) do they become veiled by a dark epithelium.

In Figs. 4 and 5 we have a light-coloured stroma and that moderate degree of pigmentation of the epithelium which is so peculiarly suitable for the observation of its cells. The enlargement of the figure is sufficient to show these cells as very fine points, with which the entire fundus appears uniformly covered.

The varieties in the colour, design, and form of the normal papilla are so great that they can be but partially considered here. In Figs. 1 and 2 the surface of the disc displays a bright spot at the place of exit of the blood-vessels, which is in fact a shallow fossa. In Fig. 3, a narrow but deep cone-shaped excavation is represented, resembling somewhat in shape a convolvulus blossom; its edges are rounded off, and its right wall sinks more obliquely than its left. Fig. 4 shows a deep central excavation with steep walls.

Fig. 5 might be easily taken for pathological, owing to the size and depth of the excavation situated at one side; it has been drawn, however, from a perfectly healthy eye. It must here be observed that Fig. 5 is not represented as more highly magnified than Fig. 4, and that the apparently increased size of the disc arises from a separation from one another of the nerve fibres. The nerve substance, which is

usually spread over the whole surface of the papilla, is here pushed into the half-moon shaped reddish space to the left; this, however, is merely an exaggeration of the physiological condition. In the normal optic nerve, indeed, the fibres do not take the course usually represented in the text-books of anatomy. They do not radiate from the centre of the papilla equally in every direction, but those nerve fibres which end in the outer half of the retina describe a curved course, running in the commencement almost perpendicularly upwards and downwards. Hence it results that that portion of the papilla which lies immediately to the outside of its centre is always the poorest in nerve fibres, and lies therefore somewhat lower than the inner side, giving it the appearance of being slightly excavated. This physiological condition is sometimes so exaggerated that it gives rise to an excavation as extensive as that represented in Fig. 5. The lamina cribrosa accordingly can be seen here as a white network, of which the grey interspaces are formed of the nerve fibres as they pass through. On the excavated side the limit of the papilla is very distinctly defined by the true nerve boundary, shown by a fine grey line, and by the broad sclerotic boundary, which a white crescent represents. These boundaries of the papilla are but slightly indicated in the other figures.

At the macula lutea (shown only in Figs. 1 and 2), the choroid is remarkable on account of its deep pigmentation. The foramen centrale is represented in Fig. 1 as a bright point, and in Fig. 2 as a small bright ring. The intensely yellow region of the retina, which immediately surrounds the foramen centrale, appears in Fig. 1 as a red spot. The greyish-white nebula in the neighbourhood of the disc and macula lutea represents the reflection produced by the most internal layers of the retina, especially in such dark eyes, and in young persons.

PLATE III.

STAPHYLOMA POSTICUM.

(SCLERECTASIA POSTERIOR, SCLEROTICO-CHOROIDITIS POSTERIOR.)

The dilatation of the posterior part of the sclerotic, which, by lengthening the optic axis, is the principal cause of short-sightedness, is accompanied by an atrophy of the stretched choroid in the neighbourhood of the posterior pole, and especially close around the optic disc. This is seen with the ophthalmoscope as a bright zone contiguous to the papilla, and within whose limits the white sclerotic is observed to be more or less denuded, the choroid which covers it being extremely thin, and destitute of pigment.

The more complete this atrophy is, the whiter does the zone appear. Upon the whole or part of its surface one may, however, usually observe the remains of the choroid in the form of grey spots. These are sometimes (Fig. 4) distinctly characterized by their shape and arrangement as intervascular territories, between which, in place of the choroidal vessels, bright spaces now appear, or occasional choroidal vessels still pass over the part, particularly at its periphery, as in Figs. 1, 6, and 7, appearing here in clear and distinct relief, while in the normal tissue they are more concealed. In the commencement, the white figure is usually of a horse-shoe, or crescent shape, being applied with its concavity to the disc, as in Fig. 3, or it may surround the latter more, as in Fig. 1; the larger it grows, however, the more irregular do its external limits become, encroaching much more upon the healthy choroid at some places than at others (Figs. 6 and 7). In Figs. 6 and 7 also, as is not unusual with such large staphylomata, are seen, not far removed from the principal seat of disease, several white spots with similar changes of tissue, and some intensely black spots, formed of collections of the epithelium of the choroid, whose shape is altered, and which contain an increased quantity of pigment.

Both the cells of the epithelium and those of the stroma undergo changes of this kind, particularly at the boundaries of the atrophied zone, so that the darkly pigmented edges, at least in places, are rarely absent, as they are represented in all the drawings on this plate. The white zone lies almost always on the outer side of the optic nerve, and even when it quite surrounds the latter, it extends most towards the posterior pole of the globe. It lies much seldomer below, or obliquely below and to the outside, as in Figs. 2 and 4. (All the drawings on this plate are made in the reversed image.) I have never seen it lie directly above the optic disc.

The direction in which the staphyloma is applied to the optic nerve has a great influence upon the shape of the disc. The latter appears, namely, in these cases, very frequently oval, especially when the staphyloma is developed for the most part, or exclusively to one side (Figs. 2 to 5). The oval is then always so placed that its smallest diameter corresponds to the direction of the staphyloma. The short diameter is accordingly placed perpendicularly in Fig. 2, obliquely in Fig. 4, and horizontally in Figs. 3, 5, and 6.

The surface of the papilla also becomes altered in these cases. Thus, in Fig. 1 is seen a shallow excavation of the entire surface, in Fig. 3 a deeper partial excavation. In the latter drawing, namely, the reddish part of the disc to the right alone lies in the normal plane; the entire white and blueish part is excavated, and becomes gradually continued into the ectatic (staphylomatous) sclerotic, so that the boundary of the staphyloma does not lie at the edge of the optic disc, but in its centre, where the large vessels make their exit. The papilla, owing to the shelving position of its surface towards the staphyloma, often appears more oval than it really is, because it is seen foreshortened. Changes in the configuration of the retinal vessels are chiefly seen upon the oval disc, when it is placed as in Figs. 2 or 4. The vessels generally take a very straight course over the ectatic part, as in Fig. 5, where the apparent increase in the number of the retinal vessels is also shown. The latter is caused by the finer vessels coming out more distinctly upon the white background.

Otherwise, the retinal vessels are normal; only in Fig. 4 are they somewhat overfilled. The fact of their appearing so much thinner than on the other plates, depends upon the smaller scale to which they are drawn. It will be found, in examining with the reversed image, that the more shortsighted the patient is the smaller will be the image which, *cæteris paribus*, we obtain; in judging, therefore, of the fulness of the vessels, &c., the latter must be compared with objects of known size, as, for instance, the disc.

The degree of the affection must not, however, be judged of by the white zone so distinctly seen with the ophthalmoscope, but the parts of the fundus which lie peripherically to this and to the disc must also be examined. Very extensive staphylomata are occasionally found, in which this zone has but a small diameter, but around it again lies another zone, within which the choroid is very tightly stretched and greatly atrophied, without, however, being so devoid of pigment as to permit of the denuded sclerotic being distinctly seen through it. Sometimes this second zone has a tolerably sharp boundary, marked by some curving choroidal vessels, which form the last branches of the vortices in the direction of the disc. Such a case is represented in Fig. 5, where, through the pale zone which surrounds the white figure and the optic nerve, several choroidal vessels run, separated by a feebly pigmented stroma; whilst, outside this zone, the intervascular spaces appear more distinctly as dark islets, in consequence of the increase of the pigment of the stroma; the same being the case in the periphery of the fundus oculi of the same patient. The epithelium at the same places being somewhat weakly pigmented, the network of choroidal vessels becomes very distinctly marked. Upon the right hand side of the same drawing, towards the macula lutea, the stroma, on the contrary, contains little pigment, but the epithelium a proportionally large quantity, thus concealing the tissue and its vessels which lie behind it.

In high degrees of sclerectasia posterior, the region of the macula lutea is very frequently the seat of circumscribed changes; pale round atrophic spots are seen, or the tissue looks cracked as it were; sometimes patches of exudation are observed on the inner surface of the choroid, as in Fig. 1, where the blueish spot with its grey edge represents such an exudation somewhat raised above the surface. By pressure upon the superposed retina, shown by the condition of the vessels which traverse it, this exudation produced considerable amblyopia. Sometimes hæmorrhagic extravasations (Fig. 6) are found in the region of the macula lutea.

PLATE IV.

DISEASES OF THE CHOROID.

FIG. 1. *Choroiditis Disseminata.*

THE small white spots in the neighbourhood of the optic nerve are formed of points of exudation, which are deeply seated in the tissue itself, and which, from the strong reflecting power they possess, look like opaque glass illuminated from behind. After the exudation has disappeared from these places, spots are left, in which the remains of the choroid may be recognized, although for the most part devoid of pigment.

Groups of such spots as those shown in the upper part of the drawing, were also present in corresponding peripherical regions of the fundus in other directions.

The large irregular white patch represents an exudation upon the inner surface of the choroid. The black spots are formed of enlarged epithelial cells containing very dark pigment. It is a peculiarity of the choroid, which we mentioned in the explanation to the last plate, that, in it, the immediate neighbourhood of circumscribed atrophic places is almost always distinguished by a stronger pigmentation, and that, too, whether the atrophy has taken place gradually or suddenly, whether it be the result of stretching or of a previous exudation or hæmorrhagic extravasation. All the drawings in this and in the last plate testify to this peculiarity. (Compare Plate VI, Fig. 2.)

FIG. 2. *Choroiditis Disseminata Syphilitica, with Secondary Atrophy of the Retina, and of the Optic Nerve.*

Although syphilitic choroiditis appears in every disseminated form, so that no one of these is characteristic of lues, yet it most frequently presents an appearance such as that afforded by this drawing; namely, the minutely spotted disseminated choroiditis, in which the small closely grouped infiltrations leave, after their absorption, very deep changes of tissue. The small white spots with dark edges come out in strong relief without any tendency to coalesce, so that they even then continue very well marked, when the remaining choroid assumes an atrophic appearance, as is shown in this drawing. The choroidal vessels which (even in the trunk in the upper part of the drawing to the left) display a disproportionately small calibre, appear here more distinctly than corresponds with the pigmentation of the individual, or with that of the rest of the fundus.

The atrophy of the retina and of the optic disc existed in a still higher degree, and in one probably but seldom observed. On the disc, which was characterised as atrophic by its colour and shape, but two slight traces of retinal vessels could be discovered, even with the use of a very much greater magnifying power, and upon the entire fundus oculi there was otherwise no mark by which the evidently highly atrophic retina revealed its presence.

Although frequently a certain degree of atrophy of the retina results in the different forms of choroiditis, from union taking place between the choroid and retina, and from infiltration of pigment into the latter, still in this case a previous and extensive affection of the retina must necessarily be admitted, which resulted in so complete an atrophy ; it had been probably a retinitis syphilitica. Still it must be mentioned, that in the atrophy which follows this latter inflammation, the degeneration of the retina into cellular tissue is usually characterised by a cloudy striated appearance of that membrane and of the papilla (vide Plate XI, fig. 3), which in this case was absent. Nothing certain can be said on the subject, as the patient only came to Berlin after the termination of the acute process.

Note.—The small spots occupy an entire zone, of which only a portion fell within the area of the drawing, which must be imagined as completed at the same distance from the centre in all directions.

FIG. 3. *Choroidal Hæmorrhage in the Neighbourhood of the Macula Lutea, in Process of Absorption.*

At an earlier period the extravasated blood occupied the entire surface of the white spot. While the narrow red crescent shows the remains of the extravasation, the disappearance of the pigment of the stroma may be observed on that part already free from blood. The white spot thus formed is separated from the healthy parts by a deeply pigmented border.

FIG. 4. *Remains of a Circumscribed Inflammatory Exudation of the Choroid, to the Inside of the Optic Disc.*

This lesion has probably a traumatic origin. The choroid within the pale spot is not completely atrophied, a fact for which the choroidal vessels which pass over it, although very small, and the remains of the tissue serve as evidence. The marbled appearance originates partly in the remains of the stroma of the choroid, and is partly characteristic of the inner surface of the sclerotic.

The stronger pigmentation at the edge, in so far as it is represented by intensely black and very fine points, depends upon the epithelial cells, which were seen with equal distinctness ; the dark greyish colouration is due to the subjacent cells of the stroma, and is particularly well seen close to the disc.

FIG. 5. *Choroidal Exudation in the neighbourhood of the Macula Lutea, with unusual changes in the Retinal Vessels.*

In a case of choroiditis, with infiltration of pigment into the retina, which extended over a portion of the external half of the fundus, and whose limits were sharply defined, a slightly prominent exudation showed itself in the neighbourhood of the posterior pole, and after an active mercurial treatment, nearly quite disappeared, permitting spots of pigment underneath to come into view. The turgescent condition of the retinal veins, which pass over the place, existed, however, almost precisely as in the drawing. The unusual form of the little vessel, scarcely visible with the same enlargement in the normal condition, results probably from the stasis of the blood, which distends a number of the finest ramifications sufficiently to make them visible upon the white background.

PLATE V.

CHOROIDO-RETINITIS.

(*Both drawings represent the same eye. Fig.* 2 *is drawn* 10 *months later than Fig.* 1.)

Louise R., aged 19 years, placed herself under my care in July, 1860, on account of a weakness of sight of the right eye, which had come on quickly, and which she attributed to having caught cold. With the left eye, which had been myopic and amblyopic from childhood, she could only imperfectly count fingers at two feet. With the ophthalmoscope very deep and extensive changes in the choroid were discovered, consisting of round disseminated spots distributed towards the periphery of the fundus, chiefly with alterations of the epithelium, occasionally also with alterations of the stroma. In the central region confluent alterations of the choroid were found, quite similar in character to those shown in Fig. 2, and as they were afterwards found in the other eye. According to the account of the patient, the vision of the right eye, which seven weeks ago was perfectly healthy, has been reduced to its present condition within the course of a fortnight. She only reads some of the letters of No. 20 of the test types with difficulty, and, while the excentric vision is tolerably good, there exists a very pronounced amblyopia in an extensive central portion of the field of vision.

The ophthalmoscopic changes, very different from those of the other eye, are represented in Fig. 1.

The choroid does not as yet appear much altered, the irregular grey spots depend almost altogether upon changes in the epithelium. The choroidal vessels are here and there faintly seen. On the other hand, very considerable opacities of the retina may be observed.

That the irregular white figure, which to some extent follows the course of the larger retinal vessels, is really an opacity of the retina, and not a choroidal exudation, is evident from its gradual continuation into the papilla, which appears consequently quite opaque, without a distinct margin, and is only indistinctly seen as a reddish object, veiled by a nebulous substance. The more opaque white parts lie, without doubt, in the posterior layers of the retina, as otherwise the blood-vessels could not remain so distinctly visible.

The condition of the vessels serves to essentially distinguish the aspect of this case from one of simple primary retinitis. The arteries are, namely, quite normal; the veins though much distended, are pretty uniformly so for a considerable distance, and not very tortuous; nor do they dip in and out of the substance of the retina in the manner which is otherwise so remarkable.

By the use of local blood-letting and small doses of corrosive sublimate, the vision gradually improved so that in the course of about three weeks ordinary type could be read, while the opacity of the retina gradually diminished. The patient was then obliged to leave Berlin, and did not present herself again until the 14th December; she now read No. 3 (Jäger) tolerably fluently, the larger letters of it, however, with some difficulty on account of small scotomata situated close to the centre

of the field. In other respects the field of vision was normal, although some hemeralopia was present. The ophthalmoscopic appearances were greatly altered, the opacities of the retina had quite disappeared, and the vessels were once more normal. The changes in the choroid, on the other hand, had become developed almost quite in the manner in which they since then exist, and as they were drawn by me (Fig. 2) in June of the following year (1861), at a time when the sight had become almost quite restored. The papilla has regained its sharply defined margin, and is sufficiently transparent to admit of the lamina cribrosa being recognised in its centre, which is somewhat excavated. The retina and its vessels show no trace of the previous changes. The choroid, on the contrary, has only retained its normal texture in a few places. In the lighter parts of the drawing, the epithelial layer is entirely deprived of its pigment, and the cells themselves are probably for the most part destroyed. In consequence of this the denuded choroidal vessels are distinctly seen, separated from one another by spaces of various appearances. At some places the stroma is thinned and weakly pigmented, at others (as at the inferior angle to the left) very much darker than normal.

The intensely black spots which are chiefly seen in the right of the drawing, are formed of degenerated epithelial cells, and probably lie partly in the retina. This cannot be determined with certainty in each particular case ; still there is in general no doubt but that, in analogous diseases, infiltration of pigment into the retina occasionally occurs.

We must also remark that beyond the boundaries of the drawing, the fundus oculi afforded to its extreme periphery the appearance of choroiditis disseminata with larger spots.

PLATE VI.

RETINITIS PIGMENTOSA, CHOROIDITIS DISSEMINATA.

Fig. 1. *Retinitis Pigmentosa.*

Retinitis pigmentosa is the name applied, with little suitability, to a disease which manifests itself in early childhood by hemeralopia and contraction of the field of vision, and which, by constant progress of the latter, gradually, towards the 30th or 40th year of age for the most part, leads to complete blindness. For years previously the patients have been incapable of guiding themselves, although they may be still able to recognize the minutest objects within their small field of vision.

Almost one-half (from 40 to 50 per cent.) of these patients are the offspring of marriages of consanguinity. This fact, which I first remarked nine years ago, has since then been confirmed by a constantly increasing number of cases. Fig. 1 is taken from an individual whose parents were blood relations (vide Deutsche Klinik, 1861, No. 6, and Archives générales de Médecine, Février, 1862).

With the ophthalmoscope, in the first place, changes in the choroid are seen. In young persons these consist in irregularities in the epithelium, which are not very striking, in older persons however, they are spread over a great part of the fundus oculi, the epithelial cells appearing to be in some places quite absent; besides this, however, there are already changes in the stroma and vessels. The former is mostly but weakly pigmented, in some places, however, very deeply so, and thus the choroidal vessels appear at some points distinctly marked, at others but faintly visible. The vessels of the choroid themselves are very irregularly filled, in very old individuals they are often for long distances completely obliterated, and changed into thin straw-coloured threads. The most remarkable change is the pigmentation of the retina. It occupies a zone, which surrounds the macula lutea and the optic nerve at some distance, and which varies much in width with the age of the patient, but is usually broader to the inside than the outside. Within this zone intensely black spots of the most different forms are seen, which upon closer examination appear composed of numbers of very small points, the only recognisable cells or pigment granules. In some situations the spots are isolated, in others they unite to form a network, as in Fig. 1.

When the very attenuated retinal vessels pass through this zone, they are often actually sheathed in streaks of pigment. The reason of this is the facility afforded to the pigment cells to pass along the tunica adventitia.

The quantity of the pigment which may penetrate into the retina is very various, and has no important influence upon the estimation of the gravity of the affection. For, even in a very advanced stage of the disease, there may be but traces of pigment in the retina, or it may be quite absent.

The atrophy of the retina, which is consecutive to its pigmentation, shows itself not only by the condition of the retinal vessels, but also in some places by an opacity and slight striation. The optic disc, which in the case here represented, appears with a distinct margin, and of a clear white colour, is more frequently opaque, striated, of a greyish red colour, and with a very irregular margin, as in Fig. 3, Plate XI. (Vide also letterpress of the same plate).

FIG. 2. *Choroiditis disseminata.*

This figure is taken from the reversed image of the left eye of a girl aged 16, whose right eye presented quite a similar ophthalmoscopic appearance. When the patient came under my treatment two years ago, she read No. 2 (Jäger) at 6 inches with the right eye, and with the left eye only some letters of No. 20.

After the use of corrosive sublimate and a derivative treatment for a period of six weeks, she read with the right eye No. 1, and with the left No. 3 at 6 inches, and this degree of vision has maintained itself with unimportant oscillations during the two years she has been under observation. I mention this in order to draw attention to the fact, that such cases form favourable subjects for treatment, notwithstanding the very extensive and remarkable changes, and the persistent ophthalmoscopic appearances. The result of the treatment is, no doubt, the more brilliant in proportion as the impairment of vision depends upon the accompanying changes in the retina.

This form of disseminated choroiditis is distinguished particularly by the nature of the changes in the epithelium : groups of epithelial cells which are enlarged and filled with abnormally dark pigment, form black spots of the most various shapes, which are almost always surrounded by a narrow light coloured border, in which the epithelium is either absent or else deprived of its pigment. These black spots are most highly developed and most closely grouped towards the centre of the choroid, in the periphery they become gradually scarcer, but still, in most cases, admit of being followed to the extreme boundaries of the fundus. In this figure the centre lies close to the left edge of the drawing, while the right edge lies very close to the furthest periphery of the fundus, as a comparison with Plate I. will show.

Around the optic disc and the macula lutea there are changes which are no longer confined to the epithelium, but which indicate a deeper invasion of the affection. In the light spots where the choroidal vessels are seen as short red stripes, not only the epithelium, but also the stroma of the choroid is deprived of its pigment, and probably also of the greater part of its cells. In some places these round, bright, black edged spots assume the appearance of choroiditis areolaris.—(Foerster.)

PLATE VII.

DETACHMENT OF THE RETINA, CHOROIDITIS CIRCUM PAPILLAM, DETACHMENT OF THE CHOROID, CYSTICERCUS.

FIG. 1. *Recent Detachment of the Upper Half of the Retina with Spontaneous Perforation.* (*Erect Image.*)

THE strongly-prominent detached membrane is still stretched tolerably tensely and smoothly, and consequently reflects but little light, permitting the red fundus, although somewhat indistinctly, to be seen through it; the fluid exuded between it and the choroid being transparent. Only at the lower limit of the detachment, on the three small folds, and at the edge of the perforation, does the substance of the retina yield a reflection strong enough to conceal the subjacent choroid with a blueish-white veil. Through the horseshoe-shaped rupture the choroidal vessels and grey intervascular spaces are seen bared, and hence extremely distinctly. The somewhat shrunken retinal flap which hangs down, lies still in the same plane as the rest of the detached part; at a later period, when the latter had become almost perfectly re-applied, and instead of it a separation of the lower half of the retina had been formed, the end of this flap alone protruded far into the vitreous humour. One could then see, more distinctly than in the drawing, a small altered place in the choroid, and the remains of a choroidal exudation with circumscribed pigmentary changes. It is probable that the detachment of the retina depended on these alterations.

FIG. 2. *Old, and almost Complete, Detachment of the Retina.* (*Erect Image.*)

It is only immediately around the papilla that the retina lies in contact with the choroid. The margin of the papilla is therefore distinctly seen, while it appears confused in those cases in which the retina is detached quite up to the papilla. The upper half of the retina is but little removed from the choroid, and is stretched tolerably flatly. The lower half, on the contrary, which towards the left stops short with a tolerably abrupt margin, protrudes further into the vitreous humour, and is much folded, in consequence of which and of the opacity of the fluid lying behind it, it presents this peculiar colouration. The vessels, which pass over the folds of the retina, appear so dark on account of the colour of the background. Their contents are normal.

FIG. 3. *Choroiditis Exudativa Circum Papillam, with Perforation of the Retina.*

The grey figure with long-pointed prolongations which surrounds the opaque reddish and distinctly-marked papilla, is formed of an exudation of a firm consistence lying upon the inner surface of the choroid. The retinal vessels run over this, and only betray its slight prominence by a few gentle sinuosities. An exudation, which has probably perforated the retina close to the optic disc, protrudes somewhat into the vitreous humour in the form of a very bright round figure, and partly covers the papilla.

The connection of the protruding exudation with that which lies behind the retina, could be demonstrated in other cases of this rare affection, which I first described at the Congrès International d'Ophthalmologie (see Compte rendu, 1861, page 21).

FIG. 4. *Detachment of the Choroid from the Sclerotic.*

This, too, is a very rare affection. (See my description in the article entitled, "De l'examen de l'œil au moyen de l'ophthalmoscope." Mackenzie Maladies des yeux. Translated by Warlomont and Testelin, and in the Archiv für Ophthalmologie, Vol. V., 1). The intimate union which exists between the choroid and the sclerotic is unfavourable to the exudation of fluid between them ; still, when such an exudation once exists, it produces a well defined, and tightly stretched tumour, which protrudes into the vitreous humour, and over which the retinal vessels run in a straight course. This affection is distinguished ophthalmoscopically from a detachment of the retina, by the absence of any folding, and by the immobility of the surface, particularly however by the fact, that immediately behind the retinal vessels slight indications of the choroid, of its vessels and intervascular spaces are observed. But at a later period the affection usually becomes complicated with a detachment of the retina in its vicinity. The detachment of the choroid is sometimes of the colour displayed in the drawing, sometimes it is a little redder, according to the general pigmentation of the individual and the composition of the fluid which separates the choroid from the sclerotic.

Incipient intra-ocular tumours may produce ophthalmoscopical appearances similar to Figs. 3 and 4.

FIG. 5. *Cysticercus Cellulosæ in the Vitreous Humour.*

The entozoon, which was originally developed under the retina, had penetrated the latter and passed into the vitreous humour. Here it presented itself so plainly, that the undulating motions and contractions of the vesicle could be recognised not only at the margin, but also on the posterior, as seen through the anterior wall. This was especially the case towards the centre, which appears of a reddish tint in the drawing, in consequence of more light shining through from the fundus at this place than at the margin, upon which the rays fall more obliquely, and are hence more strongly reflected. The neck, and especially its insertion into the vesicle are more opaque, and dotted with fine white points (concretions of chalk). This untransparent insertion of the neck is also the most resistant part of the animal, and it is there accordingly that the attempt to seize it ought to be made, when it is desired to practice its removal from the eye. Thus I seized the neck in one case with a pince-capsulaire passed through the sclerotic, while I was enabled accurately to observe my instrument and the animal, by illuminating them with an ophthalmoscope fastened to my forehead. On the head are noticed, in the drawing, two suckers, the other two being situated posteriorly. The buccal extremity is seen directed upwards. The shape of the head was not always that represented in the drawing, but changed frequently in a remarkable manner. Sometimes it lengthened itself suddenly, by protruding the proboscis which supports the buccal orifice and the circle of hooks ; sometimes it became quite flattened, and the four suckers appeared as long pedicles with antenna-like movements, similar to those of the "horns" of the snail. When the head and neck were withdrawn into the vesicle, I used to see a small fissure in the latter at the place of insertion of the neck, which gaped and became more round by the pressure of the head as it re-appeared.

The small grey round spots, which partly surround the vesicle, consist in an opacity of the vitreous humour which is characteristic of the presence of a cysticercus, and is due to its suction.

Fig. 6 represents a cysticercus still situated under the retina, as is seen by the retinal vessels which pass over it. The head and neck, which are withdrawn into the vesicle, shine through but indistinctly. The small grey streak, to the right from the glistening margin of the vesicle, is formed by the retina, which is stretched bridge-like across from the fundus to the vesicle.

PLATE VIII.

DISEASES OF THE RETINA.

Fig. 1. *Retinal Hæmorrhage in a Man aged 71 years, with Calcification of the Arteries and Hypertrophy of the left Ventricle.*

On awaking, the patient had suddenly remarked the complete blindness of his left eye, which had been until then perfectly normal; 14 days afterwards he came under my treatment. He could still count fingers quite excentrically, but in the whole of the remainder of the field he had only a slight quantitative perception of light. The ophthalmoscope revealed dark, irregular hæmorrhagic spots distributed to the extreme periphery of the fundus, and which, it appeared, occupied the different layers of the retina. The retina, between the larger spots, too, was nowhere quite free from irregularly scattered small red specks. The arteries were, in some places, quite free from blood, and changed into white threads; in other places they were filled with coagula, and only in a few branches was the circulation still free. The veins were also, for the most part, quite empty; one branch alone was almost normally filled.

The drawing was made four weeks after the patient became blind. Such retinal hæmorrhages, in old people, are distinguished by the extremely long time which they continue to exist without change. They but very gradually break up, and then partly become absorbed, and partly altered into very dark crumbling masses.

Fig. 2. *Retinal Hæmorrhage after suppression of the Menstruation.*

A woman, aged 45, after cessation of the menstruation, which had been very abundant, suddenly experienced a sensation as though something had passed across her left eye; she closed the other, and perceived then a large, round, dark spot, precisely covering the centre of the field. Immediately afterwards a singing in the ears, giddiness and vomiting came on, and lasted several hours.

This occurred on the 30th November, 1861. I examined her five days afterwards, and found a very high degree of amblyopia (she read nothing of No. 20) caused by a large scotoma, the excentric vision being normal. The form of the scotoma corresponded tolerably exactly with the hæmorrhagic extravasation discoverable with the ophthalmoscope. The condition of the eye, which existed at that time, is represented in Fig. 2 in the reversed image. The small round extravasations lie in the posterior layer of the retina; the striated spots lie in the anterior or nerve-fibre layer. The larger extravasation, covering the entire region of the macula lutea, surprised me by its peculiar shape, the more so as I had once before seen and sketched one of quite the same form, in the same position, and in a female affected under similar circumstances. That this extravasation was situated in the most posterior layers of the retina was clearly proved by small, glistening white points, which

afterwards became developed in the layers of retina lying in front of the extravasation. Within the pale figure, which almost makes the red spot a perfectly regular ellipse, there probably exists a thin and very pellucid layer of fluid between the choroid and retina. It is probable that this fluid is the serum of the extravasated blood separated from its plasma. Within this space the substance of the retina was sufficiently opaque to veil the artery completely, and to a slight degree the vein which traversed it. This opacity, as well as the small extravasations, disappeared under a derivative treatment within the course of a few weeks; the large extravasation, on the contrary, became reduced in size very gradually in the course of months, and in a centripetal direction, particularly at its horizontal boundary. During the process of absorption the patch did not break up, so that on the 8th of February, 1862, it still retained its original shape, although its vertical diameter measured but twice that of the papilla, and its transverse diameter was equal to that of the papilla. At the same time the sight had gradually improved. On the 8th April she read No. 7, and with convex 10 No. 1 within 8 inches, while only a small pale streak remained to indicate the previous extravasation. At the end of the same month the sight and the ophthalmoscopic appearances had returned quite to the normal condition. I have several times since then had opportunities of observing the same appearances, and always in women.

FIG 3. *Disease of the Vessels, Hæmorrhage and Fatty Degeneration of the Retina with Calcification of the Arteries and Hypertrophy of the left Ventricle.*

This very anomalous distribution of the retinal vessels was present in a man aged 64 years, who, for the last four years, had suffered from a high degree of amblyopia, which periodically becomes worse. The veins are in some places evidently much elongated, in others they are quite empty, the fine ramifications are very much swollen and tortuous, the arteries are fine and some of them quite obliterated. The small striated extravasations lie in the nerve-fibre layer, the large one being situated on the inner surface of the retina. The dark figures in the right upper corner of the drawing are formed of a process of the extravasation which protrudes into the vitreous humour like a membrane, vouching for the correctness of an observation often made by me, that extravasated blood retains its colour for a long time in the retina, whereas it very soon becomes dark in the vitreous humour. (Compare Plate XI., Fig. 10.) The white spots are probably partly produced by fatty degeneration of the cellular tissue of the retina, partly by sclerosis of the nerve fibres.

The patient died of apoplexy.

FIGS. 4 and 5. *Embolism of the Arteria Centralis Retinæ.* (*The same eye; Fig.* 4 *in the first days of the affection. Fig.* 5 *in the later atrophic stage.*)

This is one of sixteen cases of embolism which I have observed, and I have already once described it. (Vide Deutsche Klinik, 1862. No. 50.)

On the 25th May, 1861, Dr. Ring sent me a man aged 29 years, a musician, whose right eye had suddenly become blind the day before. Upon the 23rd he had had a severe hæmoptysis, and on the morning of the 24th, at nine o'clock, whilst going across the street, he quite suddenly remarked an obscurity of the right eye quickly coming on; this disappeared again after a few hours. At half-past three o'clock, however, upon awaking from an afternoon sleep, the right eye was absolutely blind. On the following forenoon, when he came to me, he only with difficulty counted fingers to the

outer side in a very small portion of the field of vision, while in other portions of the field there existed only, here and there, some quantitative perception of light. Already at that time, not yet twenty-four hours after the occurrence, this considerable alteration in the retina existed in the region of the macula lutea, with the characteristic red spot. The empty arteries, with their dark coagulum, the choked vessels in the neighbourhood of the macula lutea, the condition of the veins, with the retarded circulation in them, all confirmed the diagnosis of embolism, and I accordingly immediately examined the heart, notwithstanding the assurance of the patient that, with the exception of the late hæmoptysis, he had never had any symptoms or complaint which could indicate cardiac disease. The examination confirmed the supposition of valvular disease. Professor Traube had, at a later period, the kindness to examine the patient more thoroughly, and to define the diagnosis as follows :—"Insufficiency of the aortic valves, with consecutive hypertrophy and dilatation of the left ventricle, and probably a slight stenosis of the mitral orifice. Complete compensation."

During a treatment which was slightly derivative, on the whole, however, rather expectative, and after some local blood-letting, the power of vision gradually improved so far, that fingers could be counted with somewhat greater precision, and a few feet further off, although still only excentrically ; the quantitative perception of light also extending over a greater portion of the field of vision. As early as the sixth day I observed a retrogression of the changes in the retina. The milky-white opacity in the region of the macula lutea became paler, and hence the red centre more indistinctly marked ; a few very fine, cholesterine-like, glistening specks were formed, which afterwards completely disappeared. The arteries seemed in some places better filled, the dark places in them became thinner, and then very gradually vanished. The very fine ramifications also disappeared completely, which, grouped around the macula lutea, and looking as if cut off from their central branches, had been much too strongly filled, and very dark. At the same time the optic nerve and the retina assumed the atrophic appearance represented in Fig. 5.

At a later period, the patient had a cerebral embolism, with hemiplegia, which ran so favourable a course, that he could very soon afterwards play the piano with the lately paralyzed hand, while the power of vision, and the ophthalmoscopic appearances remained the same.

FIG. 6. *Infiltration and Tumefaction of the Optic Nerve (Neuritis Optici), with commencing Degeneration of the Retina in Bright's Disease.*

This alteration in the papilla, which is quite similar to that occurring in cases of cerebral and orbital tumours (compare Plate XI, Figs. 2, 11, 12, 13, 14), is sometimes developed in Morbus Brightii, quite alone, in other cases it precedes the retinal changes, and I have occasionally seen it come on after the most extensive retinal alterations had existed for a long time. In the present case, the white spots over the optic disc indicate commencing sclerosis of the nerve fibres ; the very fine white specks which are grouped around the macula lutea in the form of a star denote fatty degeneration of the radiating fibres. The extravasations are situated in the nerve-fibre layer, as may be seen from their striation.

PLATE IX.

RETINITIS ALBUMINURICA, RETINITIS HÆMORRHAGICA.

FIGS. 1 and 2. *Retinitis Albuminurica.*

FIG. 1 displays the highest development of those retinal changes which are so characteristic of Bright's disease, and are met with in no other affection. Although the microscopical degeneration of the different retinal tissues which produces the appearances here seen with the ophthalmoscope occurs also under other conditions; still, as I have already shown in the Archiv. f. Ophth., vol. v, 2, page 266, the localization and grouping is, in these cases, so exclusively peculiar, that we are thereby enabled to diagnose with certainty the renal disease solely from the ophthalmoscopic appearances.

The greyish cloudiness of the papilla and its immediate neighbourhood is caused by serous infiltration and augmentation of the cellular tissue of the retina. The white opaque zone which surrounds this portion of the fundus is produced by the sclerosis of the nerve fibres, and fatty degeneration of the cellular tissue. The latter occurs isolated in the very small round spots which are on the edge of the white figure, and which assume a star-like arrangement at the macula lutea, looking as if sprinkled upon the fundus. This, according to Schweigger, is due to the peculiar arrangement which the anterior extremities of the radiating fibres have at this place, in which extremities the granular cells are developed. The granular cells may be recognized here and there as white points.

The numerous hæmorrhagic extravasations nearly all lie in the most internal layer of the retina; the striation of the spots is produced by the arrangement of the blood corpuscles in rows between the nerve bundles, and everywhere the direction of the striæ corresponds with the course of the nerve fibres. In other cases there were also round extravasations situated in the deeper layers of the retina, and other very extensive ones situated between the retina and choroid. (Vide also the case of neuro-retinitis in Bright's disease, Plate VIII, Fig. 6.)

Fig. 2 represents another case of Bright's disease in a more advanced stage. The cloudiness and the whitish opacities have here, for the most part, disappeared, so that the persistent alterations in the macula lutea are still better seen than in the former case. There are only traces of extravasations present, and the infiltration of the papilla has almost quite disappeared, so that its margins appear again more clearly, this becoming afterwards abnormally conspicuous when atrophy of the optic nerve supervenes.

The veins, which in Fig. 1 are considerably overfilled, are here not thicker than normal, though in some places they are more tortuous. Although still thin, the arteries are still better filled than in the earlier stage, where they were almost quite empty. The white streaks, which accompany them in some places, are formed of their thickened external coat.

The small grey spots lie in the epithelium of the choroid; it is remarkable that they are nearly always seen in the same angular form, lying in groups close to one another. They may be

discovered in the earlier stage towards the periphery, afterwards when the retinal opacity has vanished, they may be followed as close to the disc as is shown in Fig. 2.

Fig. 3. *Retinitis Hæmorrhagica.*

The reversed image of the left eye. The ophthalmoscopic appearances are produced by infiltration and tumefaction of the nerve-fibre layer of the retina, by extravasation of blood into it, by emptiness of the arteries, and by repletion and congestion of the veins.

The papilla is so greatly reddened by the extravasated blood, and its usual margin so completely hidden, that it can only be discovered by means of the vessels, and by its forming the centre of radiating striæ, which correspond perfectly in their course with the nerve-fibre bundles. This striation is very well marked by the blood corpuscles being arranged in rows between the nerve-fibre bundles, indicating the course of the latter, so as to form a most instructive picture, as in this drawing, in the entire region of the optic nerve and of the macula lutea. (See my communications upon the course of the nerve-fibres of the retina in the "Transactions of the Heidelberg Congress, 1869.")

What is most striking in this figure, on the first glance, is that but a feeble indication of the arteries is seen here and there. They are so thin and pale that the opaque retina easily conceals them, and it is only towards the periphery of the fundus that they become distinctly seen. The veins, on the other hand, are very apparent in consequence of their considerable distension. They are much thicker, darker, tenser, and more tortuous than normally, and not only do they make sharper windings in the plane of the retina, but also in a plane perpendicular to it, here ascending with abrupt curves to the surface, and there sinking deeply into the nerve-fibre layer. In the latter case they are veiled by the opaque substance lying in front of them, occasionally indeed becoming completely hidden.

This drawing was taken from a woman aged 48 years, who still menstruated regularly, and was suffering from aortic insufficiency with dilatation of the aorta. It was made eight days after the commencement of the visual disturbance. The patient could read No. 20 with difficulty. The field of vision was unaffected.

In the course of five months, after a slight derivative treatment, the sight had so far improved that she read No. 11 ; the ophthalmoscopic appearances having at the same time gradually become very much altered. The papilla is now distinctly visible, its colouration and margin are normal, the arteries, but little thinner than normally, are everywhere distinctly visible, and the veins display their natural course and repletion. Only traces of the extravasations are seen here and there in the form of small patches and specks, which have a dark brownish colour. There remains but one place, 3—4 millimetres wide, situated immediately under the macula lutea, which is covered with blood. Here, however, the original regular striation no longer exists. Above the optic nerve is still seen one of the larger extravasations, which is now altered into an intensely reflecting white spot with a red border.

PLATE X.

RETINITIS SYPHILITICA, RETINITIS LEUCÆMICA.

FIGS. 1 & 2. *Retinitis Syphilitica.*

A COMPARISON between the two first figures of this, and those of the last plate, shows very distinctly the great difference between the syphilitic affection of the retina and that which occurs in Bright's disease. The opacity of the retinal tissue in retinitis syphilitica extends over an ill-defined region of the fundus. It passes from the papilla, which thereby loses its sharp margin, chiefly along the larger vessels, around the macula lutea, and somewhat further towards the periphery, where it gradually terminates without a distinct boundary. In its colour, and I might say in its structure, it appears like a pathological exaggeration of the reflection, which, even in the normal eye, the substance of the retina affords under favourable optical conditions, and particularly in individuals with very dark pigment. Only in very rare instances do we notice here and there a somewhat more opaque patch, such as that which is observed in the upper and left-hand corner of Fig. 1, or such white streaks as those issuing from the optic disc. These, however, never reflect light so strongly as the brilliantly white spots in Morbus Brightii. The same holds good for the punctiform irregularly-arranged opacities with which the region of the macula lutea is studded. The great mutability of these punctiform opacities is remarkable. I have observed them, within the course of a few days, alternately vanish completely, and then re-appear with great distinctness and closely crowded together; the patient's sight undergoing corresponding fluctuations.

In contradistinction to this, the remaining retinal opacity is distinguished by its great uniformity, by its, often, very long duration, and by the gradual transition from the inflammatory into the atrophic condition.

In the very commencement the veins are somewhat overfilled, they soon, however, return to the normal condition, and may remain so for a long time, at the end of which they very gradually become thinner; in the mean time the extreme thinness and emptiness of the arteries slowly, but plainly, announce the atrophy of the retina.

It is but exceptionally that the vessels take so active a part in the process as in the case represented by Fig. 1.

This drawing was taken from a patient aged 24 years, Leopold N. He said he had been under treatment for an indurated chancre from the commencement of December, 1860, to the middle of January, 1861. At the end of the latter month he had an inflammation of the right eye, with violent pain, redness of the eye, and cloudiness of its vision, which had given way to a mercurial treatment. Immediately afterwards, however, the sight of the left eye became considerably impaired, without any inflammatory symptom being noticed.

In the end of February he had an eruption on the face, arms, and shoulders, which gradually became cured in the course of two months. The remains of it existed as brownish spots with a slight

cicatricial depression, when he came under my treatment in the end of April, 1861. At this time, with the right eye, he read No. 4 (Jäger) with difficulty; with convex 10 he read No. 1 at four inches; with the left eye No. 14; and with convex 10, No. 10 at three inches; the excentric vision in the lower part of the field being much diminished.

Fig. 1 displays the ophthalmoscopic appearances of his left eye in the reversed image. In the upper part of the figure is seen the retinal opacity, which is characteristic of retinitis syphilitica. The appearances, however, in this case differ in some particulars from the usual form, of which Fig. 2 is an example; first, by the very great distension and tortuosity of the veins, which, in the reversed image, take an upward course, while those running in the opposite direction are remarkably thin, and in some places quite obliterated; secondly, by the already mentioned white streaky opacities, which lie upon the inner surface of the retina, and compress an entire bundle of vessels in such a way as to transform some of the branches into fine white threads.

A further deviation from the usual appearances is produced by the numerous, both old and recent, ecchymoses, which are situated partly in the different layers of the retina, partly behind the same, and partly upon its inner surface.

Moreover, the choroidal changes which here form large sharply defined spots, with diminution of the pigment of the epithelium and of the stroma, differ from those usually found. Most commonly, small and scattered spots are seen, some of them of a dark colour, and some of them light, as is shown in Fig. 2, where the epithelial cells are very irregularly filled, and I believe that these spots may sometimes penetrate into the retina during the process of progressive atrophy.

The right eye afforded the usual appearances, and in a much slighter degree, somewhat as in Fig. 2. In this eye, by the use of iodide of potassium, the opacities became lighter and lighter, while the power of vision gradually returned to the normal state.

In the left eye, however, the vision suffered considerable variations. After having improved for a short time, an extensive retinal hæmorrhage took place, which filled the vitreous humour with dark red coagula. The latter became absorbed in the course of a few weeks, but were soon replaced by still more abundant ones. In consequence of the patient leaving Berlin, I was deprived of the opportunity of observing the further alterations.

Fig. 3. *Retinitis Leucæmica.*

The principal characteristics of this case of retinitis leucæmica are:—1. The pale colour of all the retinal and choroidal vessels, especially, however, of the retinal veins, which, notwithstanding their repletion and tortuosity, have a light pink shade, similar to that of the small apoplexies. 2. The paleness of the papilla, the striated cloudiness of the retina in its neighbourhood, and the irregular spots close to the macula lutea. And 3, a number of glistening, white, round spots, which, in their form and colour, are quite similar to those found in Morbus Brightii, but differ from the latter in their peripherical situation, and hence lie beyond the limits of the drawing.

When I first described this case ("Deutsche Klinik," 1861, No. 50), I had seen but three others presenting similar appearances; nevertheless, I classed retinitis leucæmica as a peculiar form of disease of the retina, for I was convinced that it was just as dependent upon a constitutional disease as retinitis syphilitica and retinitis albuminurica.

According to my opinion, idiopathic retinitis, and indeed idiopathic retinal disease in general, belong to the greatest rarities. While in the choroid idiopathic affections are by far more frequent

than those which depend upon syphilis or other general diseases, the affections of the retina, on the other hand, either accompany local lesions of the choroid, traumatic inflammations, &c., &c., as is nearly always the case with those alterations of the retina which extend more or less symmetrically over a considerable portion of the fundus, or they depend upon irregularities in the general circulation of the body, upon disease of the heart, or of the kidneys, upon syphilis, &c. Therefore, I believed that the leucæmia was the cause of the retinitis in the present case. That the appearances of this retinitis differ essentially from those of the forms already known, speaks in favour of this view. I do not merely allude to the above mentioned colour of the vessels and extravasations, for this depends exclusively upon the colour of the leucæmic blood, but also to the colour, shape, and distribution of the opacity, as well as to the localization of the whole affected part.

Since that time I have had three more cases, making six in all, which is a very considerable number considering the rarity of splenic leucæmia. I have found, in general, the same appearances in all these cases, although modified in one way or another by the greater or less abundance of the extravasations, and by the degree of repletion of the vessels.

Seven years after I had described retinitis leucæmica as a distinct disease, Professor Becker of Heidelberg confirmed my observations. (See the "Transactions of the Heidelberg Congress of 1868.") Professor Becker afterwards published the two cases he had observed in Knapp's Archives, vol. i, No. 1.

While these pages are in the press, a communication appears from Leber ("Klinische Monatsblätter für Augenheilkunde," October, 1869), which anatomically confirms Becker's opinion, that the round white spots, and the striæ which accompany the vessels, are produced by exudation of the white blood-corpuscles.

PLATE XI.

CHANGES OF THE OPTIC DISC.

FIGS. 1, 7, 8, 9, 10. *Deep Glaucomatous Excavation of the Disc.*

THE most important characteristics of this condition are found in different degrees in each of the five figures. The very fine line which marks the separation of the nerve substance from the sheath of the nerve, the true nerve boundary, is much more clearly marked than normally. (Compare Plate I and II and their text.) The sclerotic boundary, that is to say, the circular edge formed by the sheath of the nerve as it is continued into the sclerotic, which in the normal eye is but little pronounced, forms here a distinct yellowish white ring, becoming the broader the further the choroidal boundary becomes removed from the true nerve boundary. The choroidal boundary is usually irregularly pigmented in these cases.

The surface of the papilla displays deviations from the normal colouring in the most various shades; the clearness of the centre contrasts strongly with the deep colour at the periphery, and the very dark shade of the lamina cribrosa is remarkable. The clear network of the latter is seen sharply defined, and the more so the deeper the excavation, and the more completely the nerve substance is compressed. Thus, it is most distinctly seen in Fig. 1, where, moreover, a change in the configuration of the network of the lamina cribrosa, as well as of the grey spots lying in it, admit of further conclusions; for here the lamina cribrosa has evidently not given way to the pressure directly from before backwards, but has deviated considerably downwards and outwards. The point of exit of the vessels is accordingly displaced, and especially the upper one of the three vessels seen on the papilla is forced to describe a strong curve.

The condition of the retinal vessels is that which characterises most strongly the glaucomatous excavation. In the normal eye these vessels run somewhat towards the vitreous on emerging from the disc, but here they bend sharply round on their exit, and, closely pressed against the floor of the excavation, run towards the periphery. When arrived at the nerve boundary, they seem as if cut short off. Their prolongations reappear at other places on the nerve boundary, as though they were connected in no way with the original trunks, and curve, hook-like, over the sclerotic boundary, in order to reach the plane of the retina. The apparent want of connection between the vessels running upon the floor of the excavation and their continuations, is due to the fact that an intermediate portion is hidden from view; for, in the glaucomatous excavation, the floor is larger than the opening. The vessels, therefore, which are pressed against the lateral wall, are hidden by the projecting edge, and only come again into view when they pass round the latter.

Whether the vessels running upon the floor of the excavation are equally distributed in all directions from the centre, as in Figs. 7 and 8, or whether they are all pushed to one side as in Fig. 9, and still more so in Fig. 1, depends partly upon the original distribution of the vessels, and partly upon the direction in which the nerve fibres and the vessels with them, yielded to the pressure.

The image receives, sometimes, an extremely irregular appearance from the enormous tortuosity of the very small vessels. The vascular coils thus produced, and of which Fig. 8 gives a slight indication, are sometimes so close that it is only with the most extreme attention that they can be distinguished from extravasations.

Other modifications of the circulation are observable between the nerve boundary and the periphery of the fundus. The arteries are here thin and pale, the veins enormously thick and tortuous. Figs. 8 and 9 display this in the usual form. On the other hand the condition displayed in Fig. 1, produced by a persistent vascular congestion, is to be regarded as a great rarity. I may remark, in connection with this drawing, that neither in it nor in any of the other drawings of the Atlas, has the slightest idealisation been permitted, but in this figure I have copied, for example, each individual enlargement of the vessels from nature.

If the pathological increase of the intraocular pressure ceases, the fact is immediately manifested in the changes in the vessels. For instance, in the case represented by Fig. 1, during the development of a very large anterior staphyloma, an extensive hæmorrhage took place from the retinal vessels into the vitreous humour, and all the vessels collapsed so greatly, that only traces of them could be distinguished with difficulty. Fig. 10 represents such a case in the later stage of glaucoma. The previously very distended veins are now seen extremely thin, one vessel being changed into a white bloodless thread. The extravasated blood is collected by chance in the excavation. The long dark streaks of coagulated blood stretch from the papilla into the vitreous humour.

After the iridectomy the vessels, and particularly the veins, become much thinner, the papilla assumes a whitish appearance, and the excavation becomes shallower. Figs. 7 and 8 represent both eyes of the same individual. Fig. 8, the left eye, absolutely blind in consequence of a glaucoma, which is now no longer progressive ; Fig. 7, the right eye, which, in consequence of an iridectomy performed sufficiently early, has retained a good power of vision. In the latter case I was able to establish, without doubt, the fact that the depth of the excavation had become diminished immediately after the iridectomy.

FIGS. 2, 11, 13, 14. *Neuritis optici.* (Compare also Plate VIII., Fig. 6.)

In cases of tumours in the cavity of the cranium, of exudations and exostoses on the basis cranii and in the orbit, and of tumours in the latter, a serous exudation takes place at the optic disc, accompanied by the formation of cellular tissue and fine vessels, and by considerable congestion of the retinal circulation. The ophthalmoscopic appearances of this process are the following : the entire papilla is of a reddish grey colour and opaque ; its margin is very indistinct, and situated more peripherically than the usual boundaries of the disc. The latter, as also all other normal details and shadings of the optic nerve, are completely hidden by the opacity of the superficial layers of the papilla. The vessels, too, cannot, as usual, be followed close up to the lamina cribrosa, but if they be traced from the periphery of the fundus, they become somewhat veiled on reaching the papilla, then they shine through but faintly, and disappear at last completely from observation when they sink into the depth. The substance which veils them appears, when observed with a higher power, to be composed of the more prominent radiating nerve-fibre bundles interwoven with each other, and between these the newly formed cellular tissue is here and there distinctly marked by fine striæ and specks, particularly where it is increased by the external tissue of the vessels. The numerous and extremely fine newly formed vessels wind between these striæ, often only producing the effect of a fine red

punctuation. They are best observed in the erect image; and this is easily practised in these cases owing to the considerable prominence of the swollen papilla, as its surface even in extremely myopic eyes may be seen without concave glasses, and in emmetropic eyes even with weak convex glasses, in the erect image. A better idea may, however, be formed of the shape of the prominent papilla from the reversed image, if we observe the displacements which the variously prominent parts reciprocally undergo with every motion of the convex glass.

As already remarked, the vessels show symptoms of the congestion which exists in the circulation: the arteries appear very thin and pale; the veins, on the other hand, enormously distended and tortuous. At the margin of the papilla they are usually seen sinking into the opaque nerve-fibre substance, and then bending round to reach the summit of the papilla, previously to disappearing in its centre.

Extravasations of the most varying extent often accompany the vessels; they are generally striated, and situated as in Plate VIII., Fig. 6. It would be of the greatest importance for the diagnosis of an entire class of extra-ocular diseases, to be able to distinguish with certainty three different forms of neuritis optici. 1. That one which is produced by an increase of the intra-cranial pressure and congestion of the retinal circulation (Graefe's *Stauungspapille*); 2. The neuritis which is continued along the optic nerve until it reaches the papilla (neuritis descendens); 3. The neuritis which is primarily developed in the papilla (neuritis intra-ocularis).

The degree of tumefaction and prominence of the disc, its more or less distinct striation, the definement of its boundary, the congestion of the larger veins, the abundance of very fine and newly formed vessels and extravasations; these all, in their manifold degrees and combinations, afford us signs for the framing of a differential diagnosis. Unfortunately, however, such perfect transitions exist, that in but a small number of these cases is the certain arrangement of the morbid condition in its proper class possible. Figs. 2 and 11, Plate XI., and Fig. 6, Plate VIII., represent three cases sufficiently characterised as distinct forms.

Fig. 2, Plate XI. is taken from a child suffering from chronic meningitis and afflicted with complete blindness, it is distinguished as a congestion papilla (Stauungspapille) by the very great swelling and prominence, and by the diffuse infiltration and enlargement of the disc, as well as by the enormous distention and tortuosity of the vessels. Fig. 11 represents a neuritis descendens in a case of orbital tumour. Although here, too, the boundary of the optic disc forms a much larger circle, because the cloudy nerve substance hides the lines which normally indicate the boundary of the papilla, still this increase in size is by far less remarkable than in Fig. 2, the prominence, especially, being much slighter. The opacity is not diffuse, but is composed of radiating striæ, corresponding to the nerve-fibre bundles, and the veins are much less filled and tortuous. The case shown in Plate VIII., Fig. 6, is one of neuro-retinitis intra-ocularis, and differs from the last two cases not only in the appearance of the papilla, which is best appreciated by a comparison of the drawings, but particularly in the fact that the affection is not confined to the papilla alone, but extends into the retina itself. Still it cannot be denied that quite similar alterations, extending quite as far into the retina as in this case of Bright's disease, may also occur in cerebral affections, and especially in cases of tumor cerebri. Care must, therefore, be taken not to draw too minute or apodictical conclusions from the ophthalmoscopic appearances in neuritis optici.

The appreciation of the appearances is made more complicated and difficult by the gradual changes which the optic nerve undergoes in passing from the inflammatory over into the atrophic stage. Figs. 13 and 14 of this plate represent both eyes of an individual suffering from a tumour of the brain,

attended with violent headache, vertigo, giddiness which tended towards one side, weakness of memory, a general sinking of the mental faculties, weakness of the lower extremities, &c. The opacity of the optic nerve is already on both sides retrogressive, and the commencing atrophy is particularly well pronounced in Fig. 14. Very instructive is the comparison in this drawing between the opaque and prominent half of the papilla and the other atrophic and slightly excavated half. By covering the right half of the drawing, the picture of a neuritis may easily be completed by imagination, and *vice versâ*, the picture of an atrophy of the optic nerve by covering the left half.

If the atrophy be complete, it is, of course, impossible to decide by which of the different forms of neuritis it has been produced. The only question, then, is to discern that the atrophy is consecutive upon a neuritis, that is to say, to distinguish this from other forms of atrophy. For this purpose the ophthalmoscopic appearances supply us, almost always, with sufficiently well marked signs.

FIGS. 3, 4, 5, 6, and 12. *Atrophy of the Optic Nerve.*

Atrophic conditions are seen at the entrance of the optic nerve, as the results of very different affections :—1. Diseases of the retina, as, retinitis hæmorrhagica, retinitis albuminurica, retinitis syphilitica, retinitis pigmentosa, embolism of the arteria centralis retinæ, neuritis optici. 2. Glaucoma. 3. Certain diseases of the optic nerve, or its sheath, with which, until now, we are little acquainted (Von Graefe, Leber). 4. Lastly, different diseases of the brain and spinal chord.

The ophthalmoscopic appearances vary greatly, according to the nature of the disease which has preceded the atrophy. A comparison of these figures with Fig. 2, Plate IV, Fig. 1, Plate VI, Fig. 5, Plate VIII, will illustrate this most clearly.

Fig. 3. Consecutive atrophy of the optic nerve after retinitis syphilitica. (Left eye, reversed image, enlarged 15 diameters.) The uniform blueish-grey colouration, the ill-defined margin, the entire absence of any stippling or shading which would indicate the lamina cribrosa, all these signs depend on the formation of a mass of cellular tissue, whose fibrillæ follow the course of the nerve-fibres, being precisely represented in the drawing by a very fine grey striation. In the examination with the erect image it is very easily seen that this newly formed tissue lies in the most superficial layers of the papilla, or, rather, extends up to its surface. Hence it is that the choroidal, sclerotic, and true nerve boundaries of the papilla are veiled, as well as the lamina cribrosa. If the optic disc be strongly illuminated, it assumes a somewhat yellowish appearance, in consequence of the light being reflected from the depth by the lamina cribrosa; the more feeble the illumination is, on the other hand, so much the more apparent does this striation and its blueish-grey tint become.

Fig. 4. Partial atrophy, and shallow excavation of the optic disc, caused probably by a retro-ocular affection of the nerve.—There existed a considerable reduction in the acuteness of central vision, and a complete defect of an upper and inner portion of the field, without any symptom of cerebral or general disease. While the yellowish-red part of the papilla, situated to the left, in which the greatest number of the vessels lie, represents the still normal portion; the lamina cribrosa and the boundaries of the optic nerve have become very distinctly visible in the much more extensive part lying to the right, in consequence of the atrophic destruction of the nerve-fibres and the resulting excavation. These characteristics establish a marked difference between this form of atrophy and that which follows a retinitis or neuritis (Fig. 3 and Fig. 12 of this Plate). On the other hand, this shallow excavation, produced merely by destruction of the nerve-fibres, is distinguished from the glaucomatous form, brought on by increased intra-ocular pressure, by the fact that the lamina

cribrosa remains in its normal position, while in glaucoma it is displaced backwards (Figs. 1 and 9), the vessels, too, undergoing much more extensive deviations.

Fig. 5. An atrophic, shallowly excavated papilla, taken from a man aged 40 suffering from locomotor ataxy, and completely blind.—The blueish-grey colour, and great distinctness of the lamina cribrosa, and of the nerve boundaries, combined with the repletion of the vessels, especially of the veins, which, although thinner than in the normal eye, are considerably larger than in other cases of atrophy, all these appearances, although not characteristic of spinal amaurosis, seem to me to occur most frequently in such cases. In order to prevent any mistake as to the degree of repletion of the vessels in comparing Figs. 3, 4, and 5, it must not be forgotten that Figs. 3 and 4 are drawn with an enlargement of 15 diameters, and Fig. 5 with an enlargement of but 10 diameters.

Fig. 6. Atrophy and shallow excavation of the optic nerve, consecutive to meningitis, in a girl aged 19.—The atrophy was gradually developed, and accompanied by a high degree of amblyopia. The most frequent ophthalmoscopic appearances in cerebral amaurosis are displayed by the very highly reflecting and chalky-white papilla, with its well-defined margin, and by the extremely thin vessels, which are accompanied in some places by white lines.

Fig. 12. Atrophy after neuritis optici in a case of orbital tumour.—Fig. 11 represents the same eye two years previously, during the inflammatory stage. Both figures are drawn with the same enlargement. Their comparison, therefore, shows, first, how far the clear disc, which is the seat of an inflammatory swelling, apparently extends beyond its proper limits; and secondly, how, in the atrophic stage, the veins have not only lost their greater repletion, but have also, in some places, altered their course, in consequence of a diminution in their tortuosity.

This figure is allied most closely to Fig. 3 (atrophy after retinitis syphilitica), and differs very much from the other cases of atrophy (Figs. 4, 5, and 6) in the ill-defined margin, the blueish-grey, nebulous colour, above all, however, in the complete veiling of the lamina cribrosa. This latter symptom appears to me of the greatest possible importance for the differential diagnosis of the various forms of atrophy, and I draw particular attention to it here, as it has not yet been appreciated as it deserves to be.

PLATE XII.

CONGENITAL ANOMALIES.

FIGS. 1 and 2. *Nerve Fibres with Medullary Sheaths.*

THE optic nerve, as is well known, is opaque as far as the lamina cribrosa, but from thence onwards its anterior extremity becomes sufficiently transparent to admit of the lamina being seen with the ophthalmoscope, and of the vessels being traced close up to it. The opacity of the trunk of the nerve is doubtless in a certain degree attributable to the cellular tissue which enters into its composition; it is, however, principally due to the histological character of the nerve-fibres, which retain their medullary sheath until they reach the lamina cribrosa. In some animals, as for instance the rabbit, a certain number of the fasciculi of nerve-fibres retain their medullary sheath for some distance beyond this point. In consequence of these opaque fibres reflecting the light very strongly, this anatomical arrangement produces the effect of two glistening white fans, which in these animals radiate out from the optic disc on each side, with the fine striæ which border them. Sometimes an analogous condition is found in the human eye, and it is important to be able to recognise it, not only because it is by no means very rare, but because even the most practised diagnostician may, from its very remarkable appearance, be induced to consider it due to some pathological change. The possibility of such a mistake is proved by many drawings and descriptions. I have accordingly dedicated to this subject a proportionally large space in these plates.

The fundus of the eye presents very different aspects, according as the medullary sheath is persistent in a greater or less number of nerve-fibres, and as it remains so in a longer or shorter part of their course, and, again, according as it is either an immediate continuation of the opaque portion of the nerve, or, on the other hand, separated from the latter by a more or less extensive interval in which the nerve-fibres are transparent. But there are some characteristics which are common to all cases of this kind; first, the brilliancy with which the white figure is distinguished from all others which come under our observation; further, the extreme sharpness with which the individual nerve-fibre bundles are seen, and especially at the margin; lastly, the complete or partial disappearance of the retinal vessels during their passage through the opaque region. The shape of this patch varies greatly; frequently it resembles Fig. 2, where the peripherical outline terminates in the characteristic flame-like processes. The boundary, which is directed towards the optic nerve, is sometimes removed as far from it as is shown in the drawing, and sometimes still further, or it may encroach on the papilla, then completely concealing the corresponding portion of its margin. In other cases the anomalous region forms a white, sharply defined, bean-shaped spot, and then the diagnosis may become truly difficult.

Besides the large spot some small tufts or solitary rays are often found on the opposite side of the disc. There is an indication of this in Fig. 2. It is very rare, however, to find a spot near the

periphery where the nerve-fibres are opaque, while a transparent part of the retina intervenes between this and the optic disc. Such a condition is represented in Fig. 1 in the upper corner to the right. In this case the anomaly is of so extreme and rare a degree, that I should not have thought it advisable to insert such an unusual drawing were it not that in it all the various details to be observed are marked with peculiar distinctness.

FIG. 3. *Pigmentation of the Optic Nerve in a case of Cyanosis Oculi.*

I have seen but five cases of Cyanosis Oculi, and the essential characters of each were the same. The anomaly was present in but one of the two eyes, which differed from the other in the much darker colour of the iris and in the presence of spots upon the sclerotic, which were of a greyish colour, verging on violet. In only one of these five cases did I find the optic papilla itself highly pigmented, and I have depicted this case in Fig. 3.

Herr S., aged 21 years, has dark blond curly hair, moderately light eyebrows and eyelashes (similar on both sides); the iris of the left eye is light brown, that of the right eye of such a deep brown that it is almost black, and it is only by close observation that the pupil can be observed. Around the cornea, at some distance from its margin, the sclerotic is covered with groups of dark grey, almost violet, spots.

On ophthalmoscopic examination but a very weak and deep red reflection is obtained from the pupil; in the direction of the visual axis the reflection disappears almost entirely, while upon the observer looking in the direction of the optic nerve only a slight admixture of white is obtained. With the reverse image, the fundus appears in general of a dark reddish-brown colour; upon employing magnifying power an increased enlargement, the dotting of the epithelial cells of the choroid, is seen as greyish-brown specks upon a dark red ground. Only in some parts of the fundus are traces of the choroidal vessels discernible. In other cases, where the pigmentation of the epithelium was deeper, no trace of these vessels was anywhere visible.

Upon this dark background the retinal vessels appear much darker than otherwise, and the reflection from their anterior surface much weaker. On the other hand, the substance of the retina is particularly well marked by a light blueish-grey reflection, somewhat like that which an extremely thin layer of fat would give, and which plays over the fundus with every motion of the mirror. This reflection, likewise, surrounds the macula lutea, which is almost quite black, its centre being surrounded by a dark rust-brown areola. The latter is caused by the yellowish colour of the retina in this place, which in a light-coloured fundus produces a deeper red than elsewhere. The papilla appears in general reddish, and its contour is only well marked towards the outer side. The vessels emerge tolerably near the centre, and their point of exit is concealed by thick tuft-like black striæ, which cover about the third of the papilla, causing, therefore, that portion to appear black, which in the normal eye has the lightest tint. At the periphery, too, close within the margin, a little pigment shows itself. This appears, however, to lie more deeply at the lamina cribrosa, while the central pigmentary tufts permeate more distinctly the nerve-fibre bundles towards the surface of the optic disc.

I may observe that this eye is myopic, but possesses good acuteness of vision, and, the other eye being amblyopic, it is made use of exclusively.

FIGS. 4 and 5. *Coloboma Choroideæ et Vaginæ Nervi Optici.*

In almost all the cases of coloboma iridis et choroideæ which I have examined the same

ophthalmoscopic appearances were found, although developed in different degrees. A white oval patch was seen, whose upper end was directed towards the optic nerve, or even included the latter in it, while below it, more or less, approached the ciliary processes. This space was traversed by isolated retinal vessels and very thin choroidal vessels, the latter describing a very unusual course, and disappearing at last in the highly pigmented choroidal margin. The optic disc, when included in the coloboma, presented a well-defined margin superiorly, but in other directions was but indistinctly distinguishable from the blueish-white sclerotic, by its more reddish or greyish tint. The papilla was elliptical in shape, with its long axis placed horizontally.

The distribution of the vessels on the papilla differed very much from that of the normal arrangement, which was chiefly due to the fact that by far the greater number of the branches curved upwards on emerging, while only some isolated and very thin vessels were directed downwards.

Fig. 5 is taken from a young girl who suffered from coloboma iridis in both eyes. The right eye could be but little examined with the ophthalmoscope, owing to a secondary cataract and a detachment of the retina, consecutive to a previous reclination of the lens. In the left eye, on the contrary, after dilatation of the pupil, which was already large in consequence of the coloboma iridis, the fundus might be observed as far as the ciliary processes, especially below; and thus the large coloboma choroideæ could be seen in its entire extent. Towards the margin of the latter the elsewhere moderate pigmentation of the choroid suddenly increases in its intensity, and terminates with a dark brown, here and there almost black, edge, which stands out distinctly against the clear white patch. In the entire extent of this space the sclerotic is very much ectasied. The boundary, where this ectasy begins, is for the most part covered by the dark choroidal border, only below (in the drawing accordingly, which is in the reversed image, above) where the patch runs out into a peculiar point, surrounded on both sides by an increased deposition of pigment, does a zone of sclerotic remain in its normal plane, between the choroidal border and the edge of the ectasy. This point is evidently continued into the raphé, which passes from the choroidal coloboma to that of the iris, and pressed to whose side lie several rudimentary ciliary processes, as Arlt has so well described it anatomically. At the inferior margin of the ectasy the edge of the sclerotic is very well seen, over which all vessels must turn in order to descend into the concavity. This edge forms the large pale arc in the upper part of the drawing. Below this the sclerotic, still lying in the normal plane, is covered with remains of a weakly pigmented choroidal tissue, while above it the ectasied part is brilliantly clear, showing blueish-marbled windings and shadings, which are peculiar to the ophthalmoscopic appearance of the sclerotic tissue. The depth of the ectasy increases from the large arc to about the centre of the whole coloboma. At this place a second arc, lying almost concentrically to the first, but less pronounced than it, indicates the limit of a still more ectasied part, which, if the globe could be seen from behind, must look like a smaller knob sitting upon the larger one. This second small arc also manifests itself as a rounded edge, both by the shading, as well as by the manner in which most of the vessels are obliged to turn over it. The papilla is oval, with its long axis placed horizontally, and it is difficult to distinguish it from the sclerotic by its more reddish-grey hue. Its surface is not situated, as usual, in a plane perpendicular to the optic axis, but the side which is directed towards the coloboma is greatly pushed backwards, so that hardly any other than a fore-shortened view of it is obtained, and hence it appears narrower from above downwards than it really is.

The mode of distribution of the retinal vessels upon it is extremely characteristic of the coloboma. When compared with the normal condition they appear to be bent at an angle of 90° in the plane of the fundus oculi. From the papilla the retina, or the rudimentary membrane which here

probably takes its place, is stretched across the smaller and deeper ectasy, while in the entire remaining extent of the coloboma it is closely applied to the floor of the concavity. This may be easily recognised by observing the retinal vessels ; for, besides those vessels already mentioned, two veins and an artery may be seen appearing at some distance from the papilla, which seem to issue out of the sclerotic, but in reality emerge from a fold of the retina which conceals their true origin. If these vessels be attentively followed along their entire course on the coloboma, while slight movements are made with the convex lens, it is seen that throughout the whole extent of the small deep ectasy they alter their relations with the fundus of the eye, and with the choroidal vessels which pass over it. The choroidal vessels describe a tortuous course over the whole of the white patch from above downwards, possessing, indeed, no resemblance to normal choroidal vessels. By an attentive examination, however, their true nature may be recognised by their emerging out of the sclerotic, and passing into the choroidal tissue, by their close adherence to the sclerotic, and by their displacement, as above described, against the retinal tissue which is stretched over them. The latter membrane attains an appearance similar to that of a transparent detachment of the retina, both by its displacement against the fundus, as well as by its somewhat stronger reflection, and by its concealing the vessels here and there with folds.

Fig. 4 represents a case of coloboma vaginæ nervi optici. At the place of entrance of the optic nerve in the left eye, a clear round disc was seen, of the same greyish, transparent colour as the optic nerve, and separated, as it were, from the rest of the fundus oculi by those lines which I have described as the choroidal, sclerotic, and true nerve boundaries of the papilla.

From the centre of the upper third of this disc a retinal artery and vein emerged side by side, and, passing directly upwards and inwards, gave off all the principal branches towards the upper part of the fundus (in the drawing reversed), while only a few thinner branches traversed the disc below, some of them describing a tortuous course. The latter vessels were here, where the surface appeared to be formed of a transparent folded membrane, occasionally hidden by dipping into this ; upon reaching the edge of the disc they turned sharply round, and passed over the sclerotic and choroidal boundaries, describing thereby a hook-like curve. This arrangement of the vessels drew my attention to the fact that the surface of the disc, although in general level, must still lie somewhat deeper than the rest of the fundus. A more attentive examination showed, moreover, that the membrane which formed the two inferior thirds of the disc was stretched across two oblong and tolerably deep depressions, separated from one another by a narrow band.

The true signification of this ophthalmoscopic appearance was first made clear to me when I examined two eyes from among a number of preparations which Professor Arlt had the kindness to place at my disposal. In these two a coloboma iridis et choroideæ was accompanied by quite the same appearance of the papilla as that above described. Having made a longitudinal section of the optic nerve, I found its sheath dilated into a deep pocket below the papilla, previous to its passing into the sclerotic. A membrane which emerged from the papilla was stretched across the opening of this pocket, while the edge of the latter was continued into the sclerotic border on the upper side of the papilla, the only place where the border was contiguous to the papilla. Thus a ring was formed around the papilla of double the diameter of the optic nerve. The ectasy itself was not a uniform one, but had two deeper compartments, which, when regarded with a magnifying-glass, afforded quite the same effect as those oval depressions in the grey disc which I had seen with the ophthalmoscope.

On account of the age of the preparation I cannot give any minute details about the membrane

which was stretched over the ectasy. I believe, however, that although continuous with the optic nerve and retina, it did not contain any retinal elements.

Moreover, in all those cases of extensive coloboma choroideæ, which I have examined during life, I believe myself to be justified in concluding, that the membrane, which extended over the choroidal fissure as an apparent continuation of the retina, contained few, if any nervous elements, and I have been led to this conclusion from the shape of the papilla, from the arrangement of the vessels, and from the defect in the field of vision which is almost constantly found.—(Vide Archiv. für Ophthalmologie, v. ii, page 241.)

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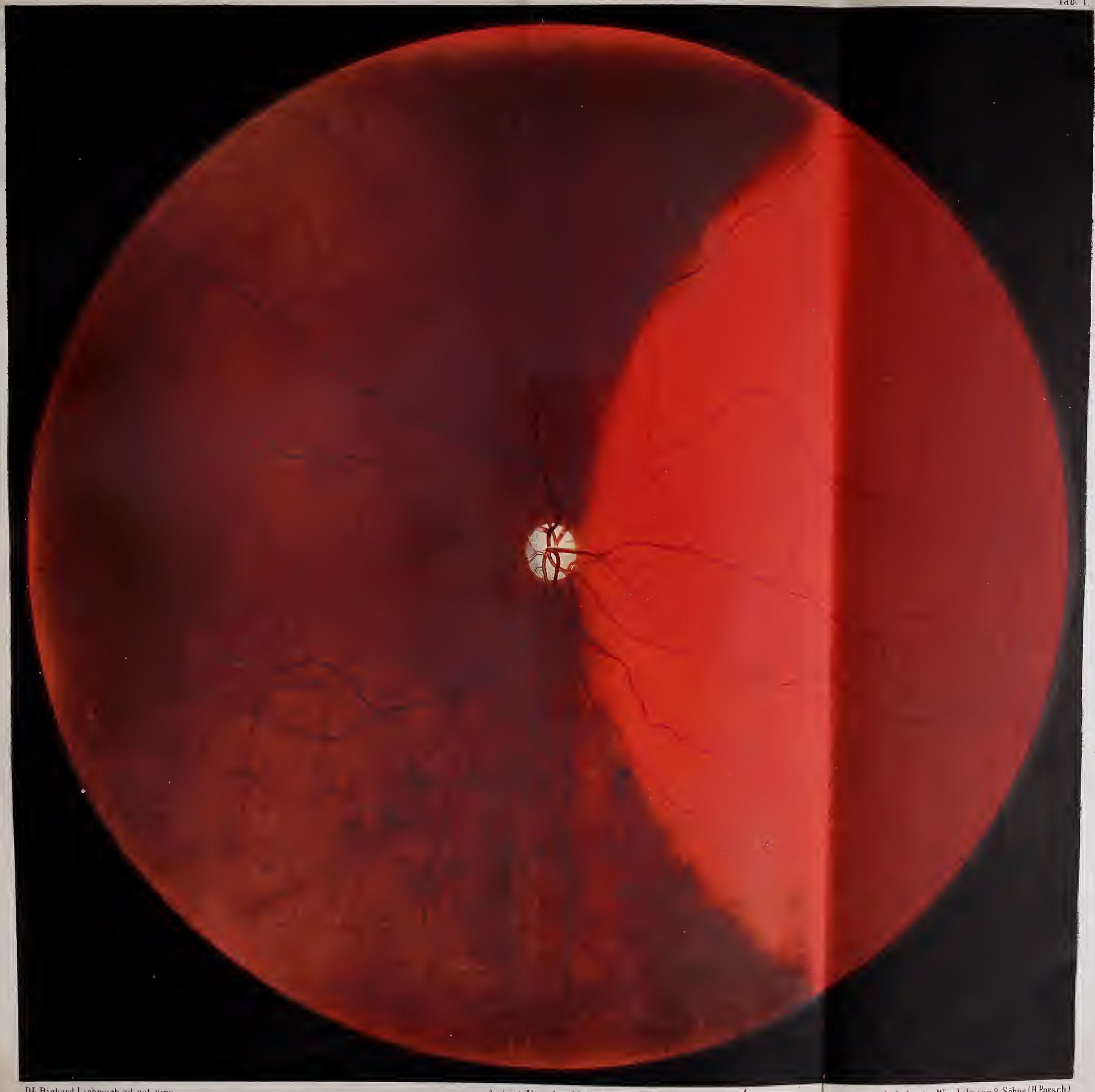

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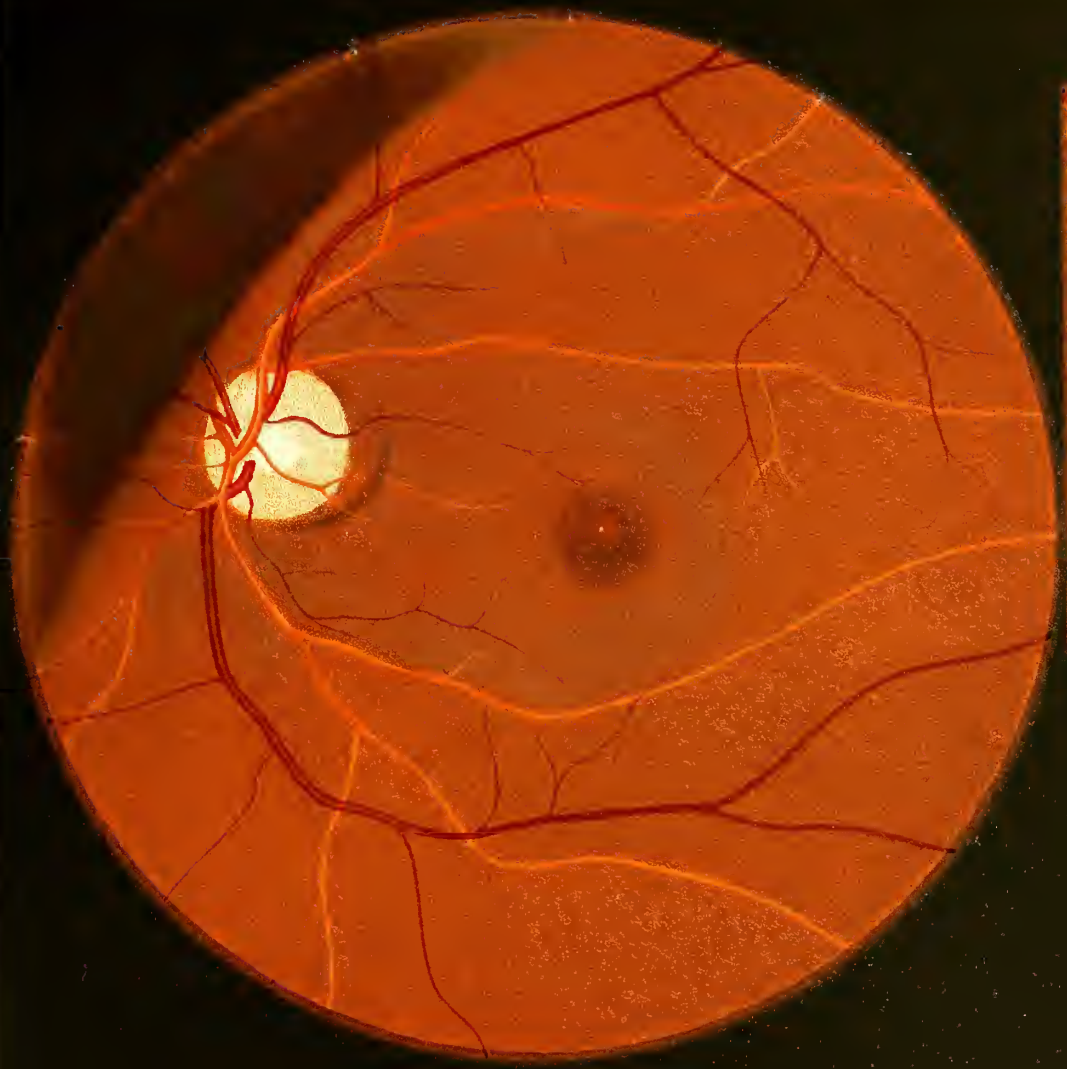

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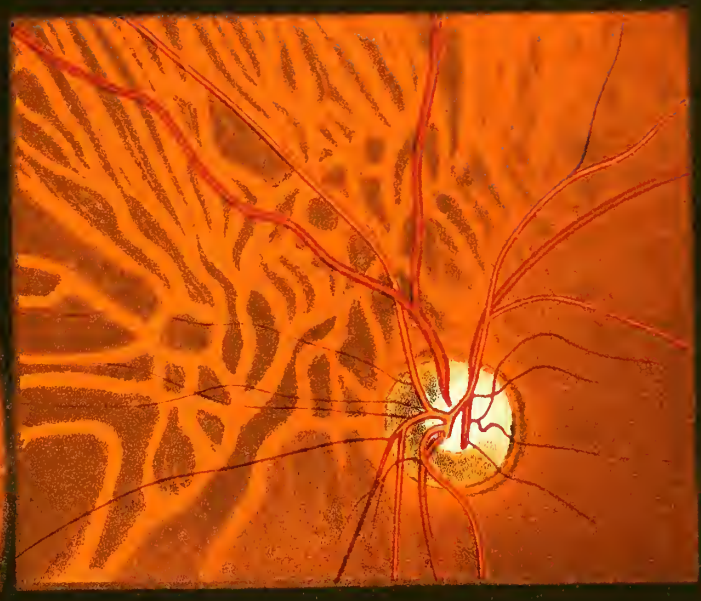

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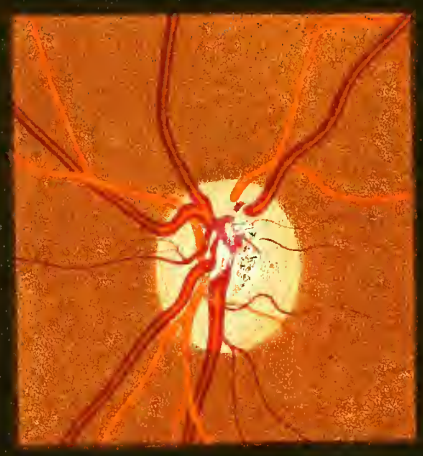

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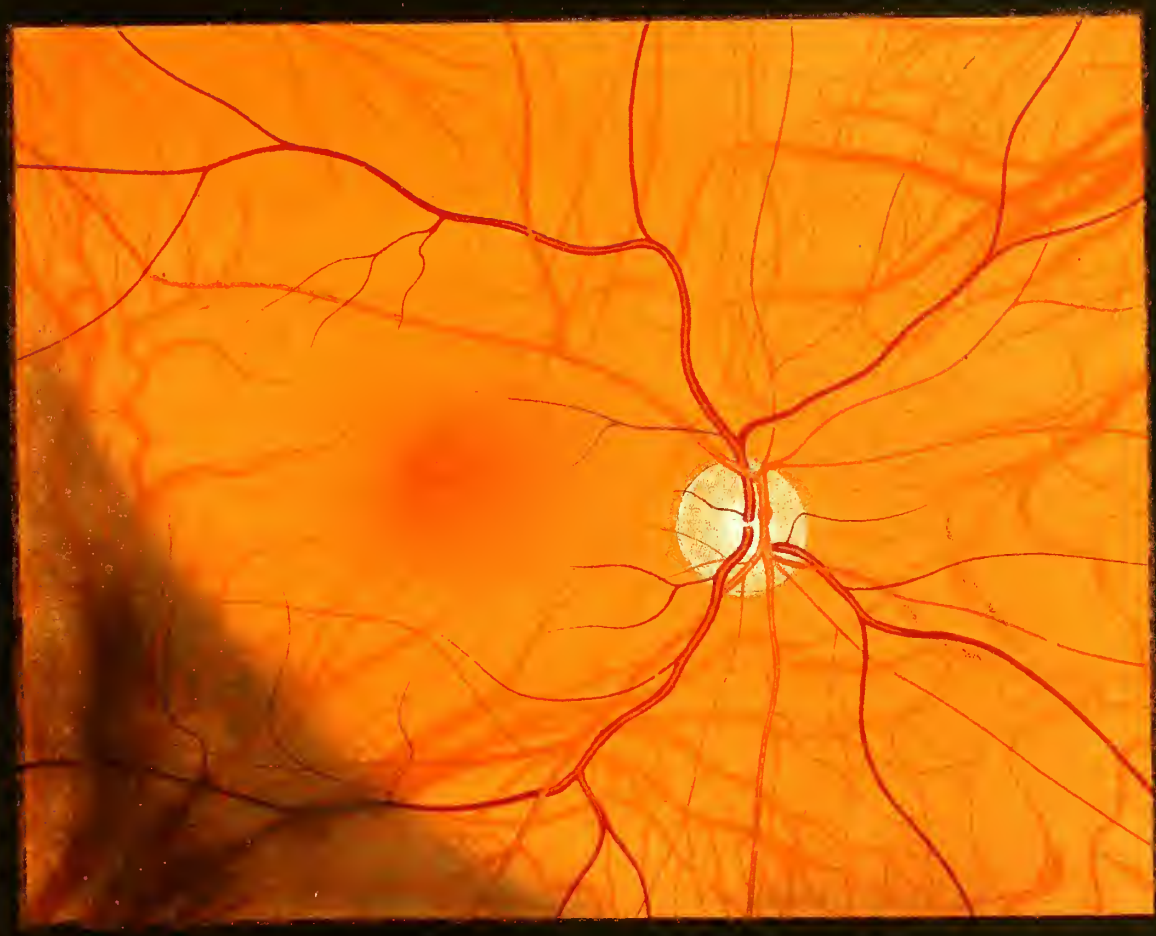

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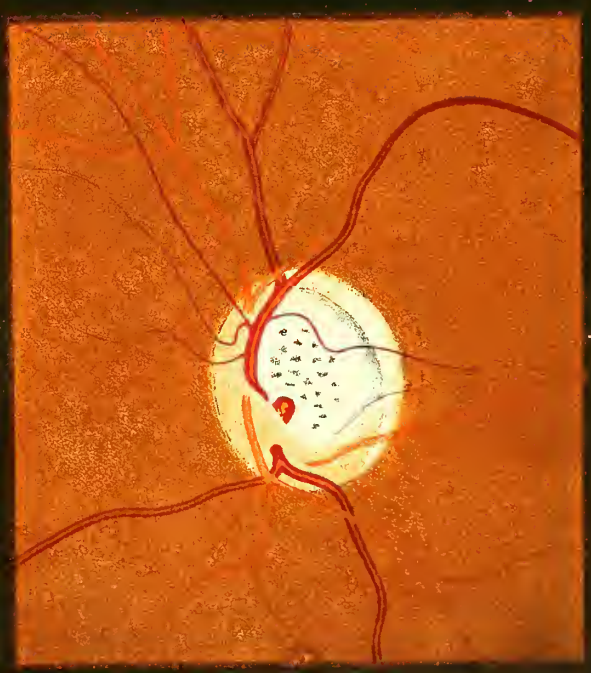

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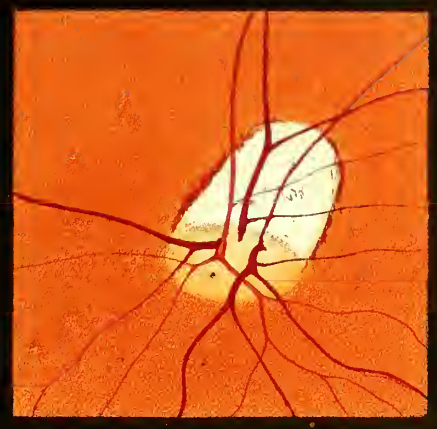

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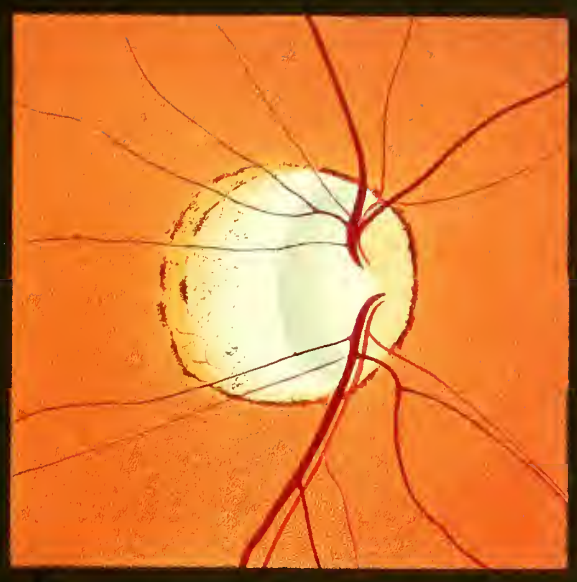

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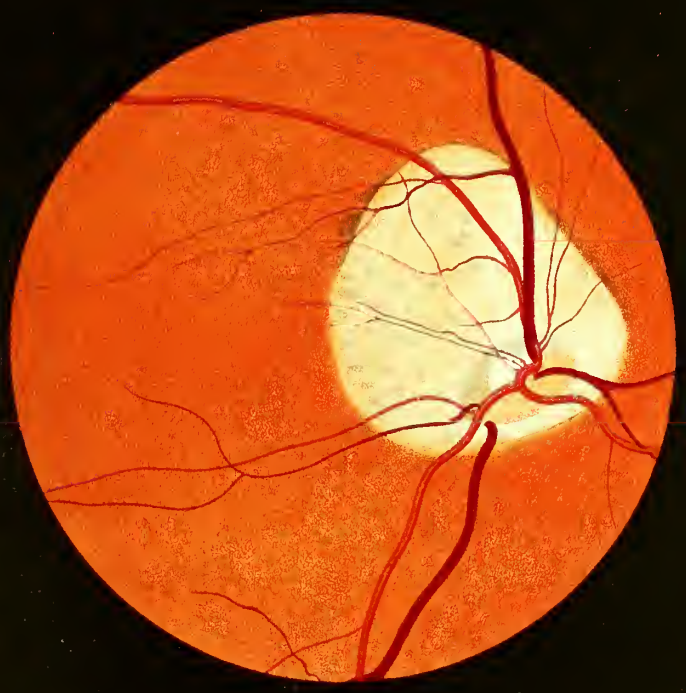

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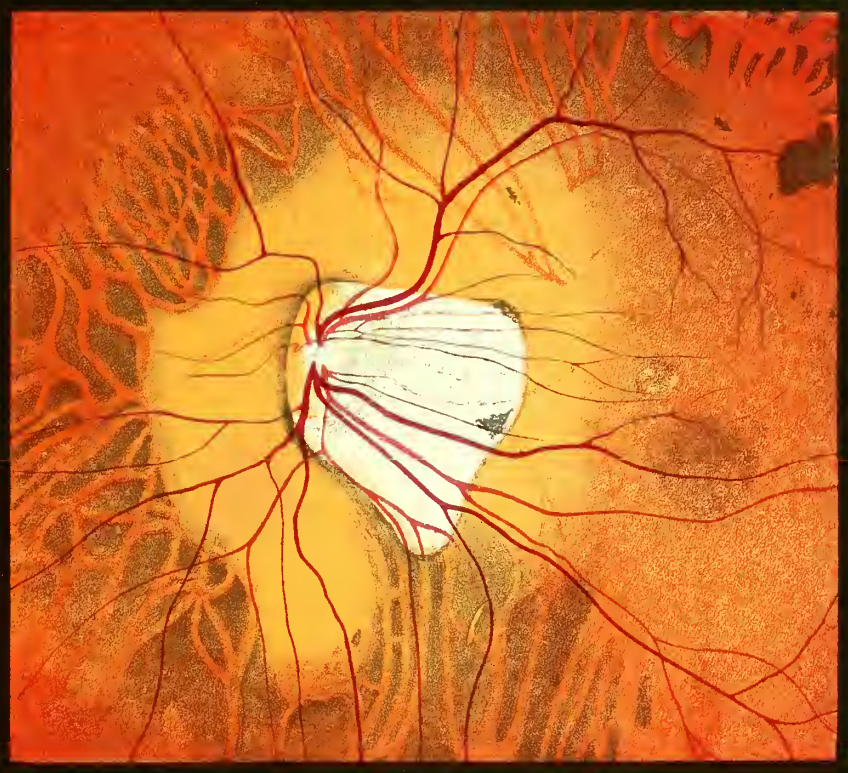

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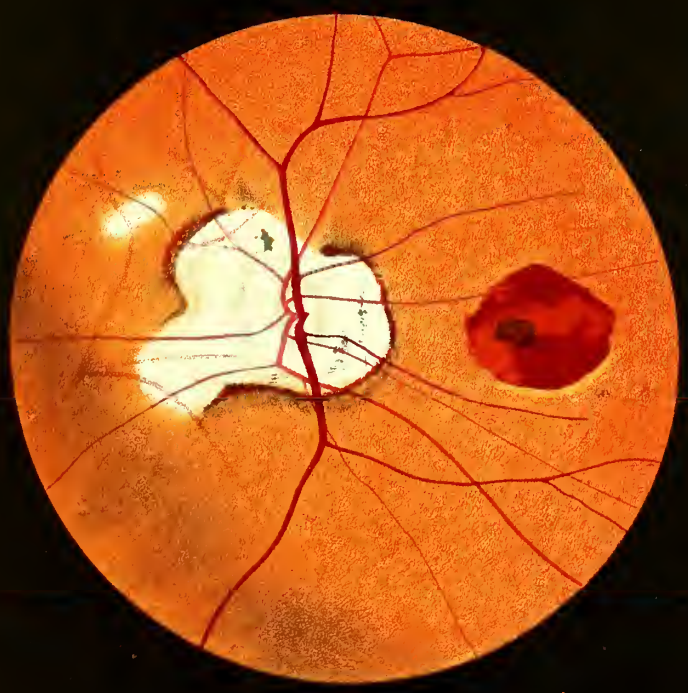

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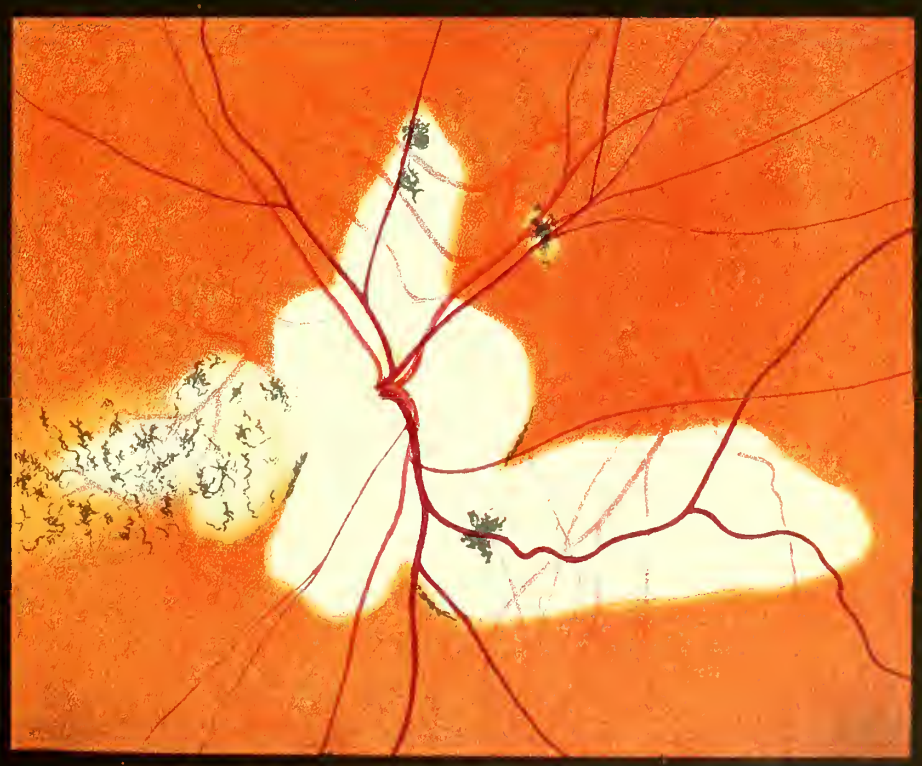

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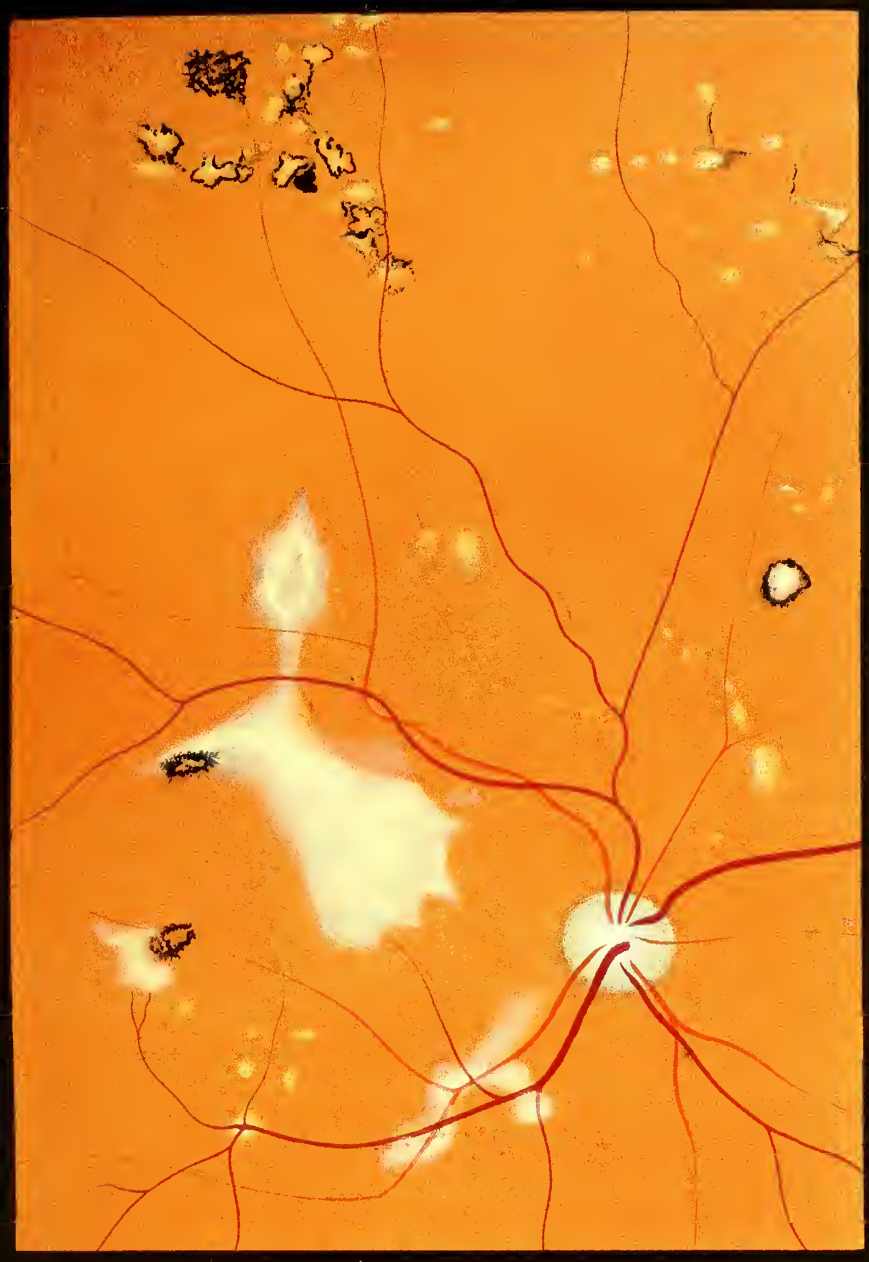

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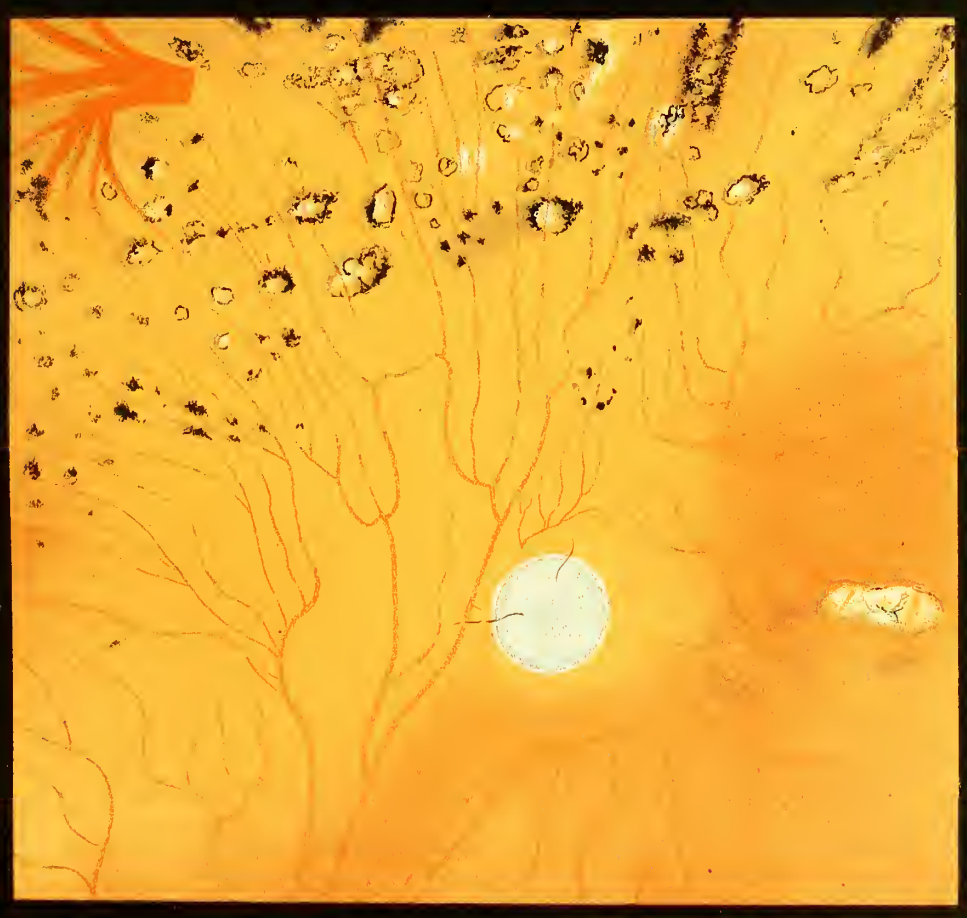

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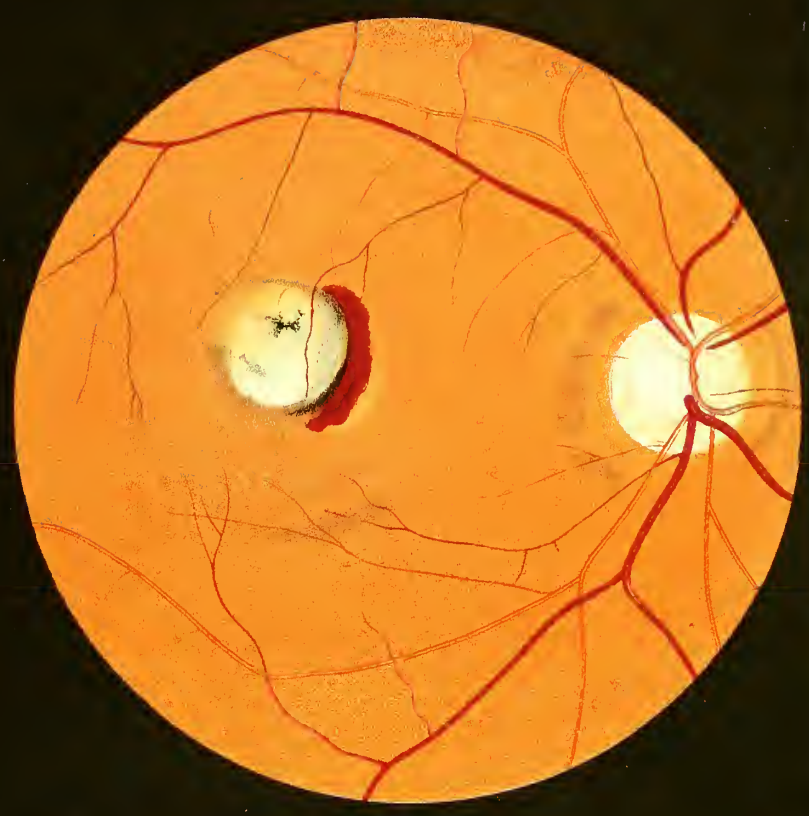

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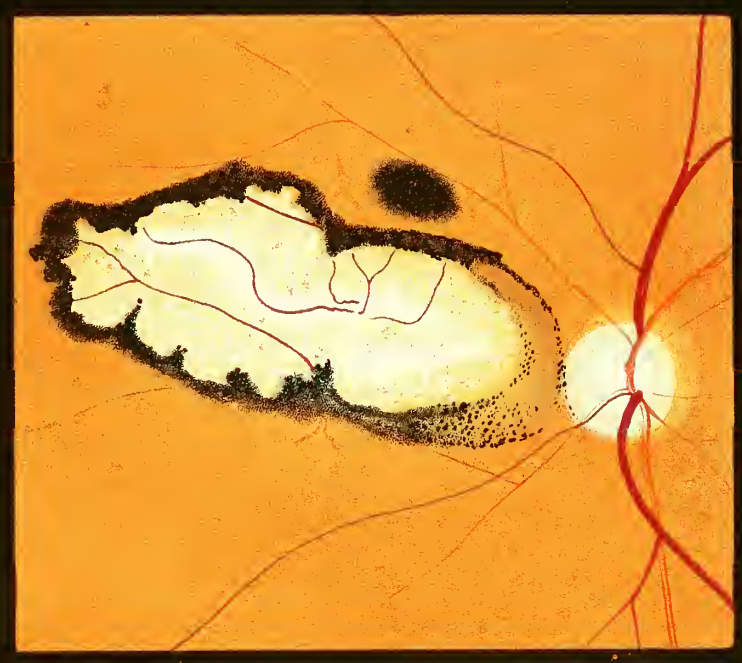

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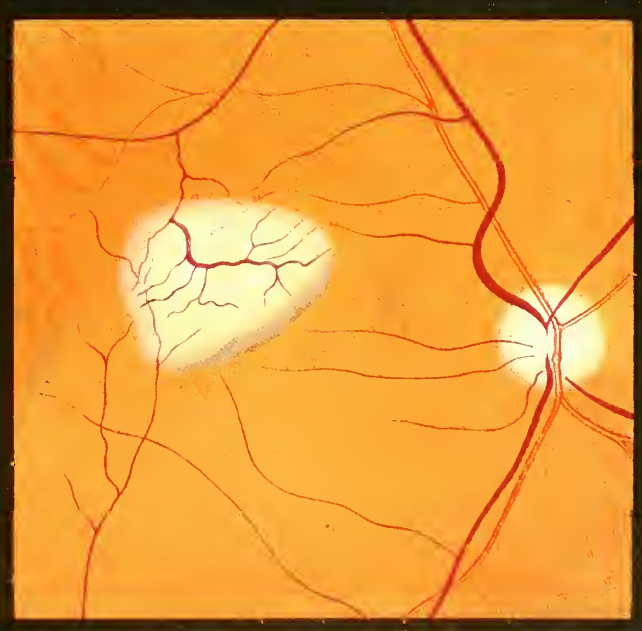

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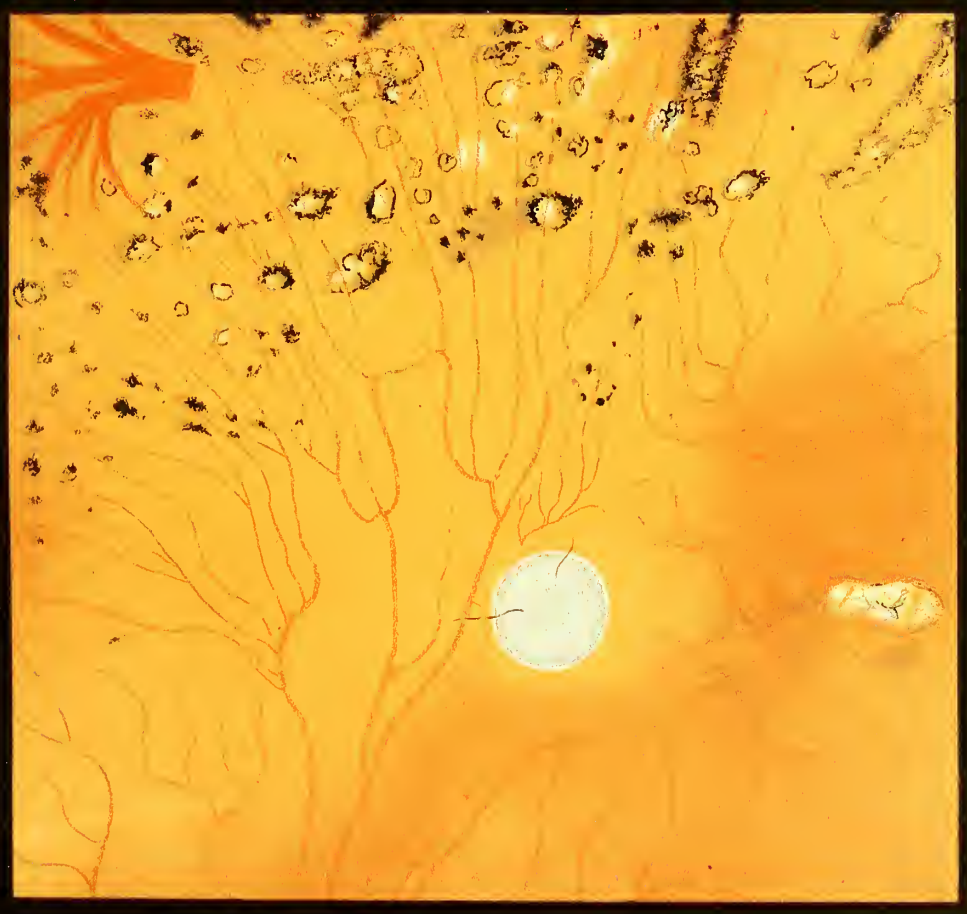

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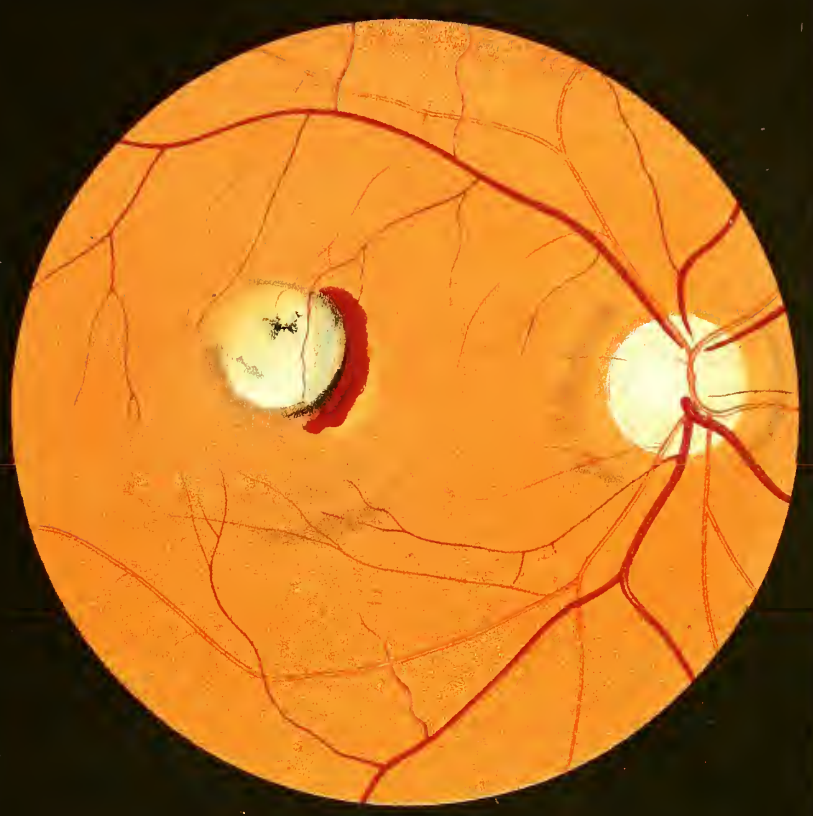

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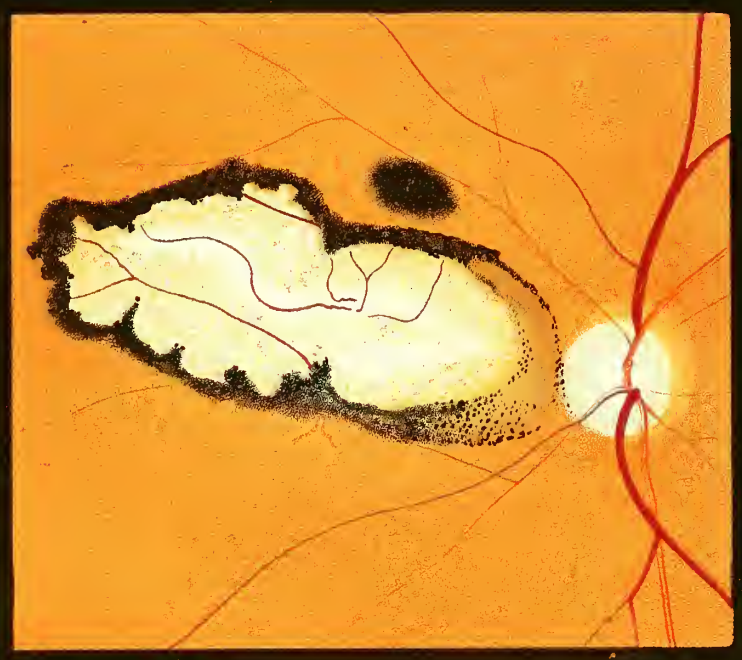

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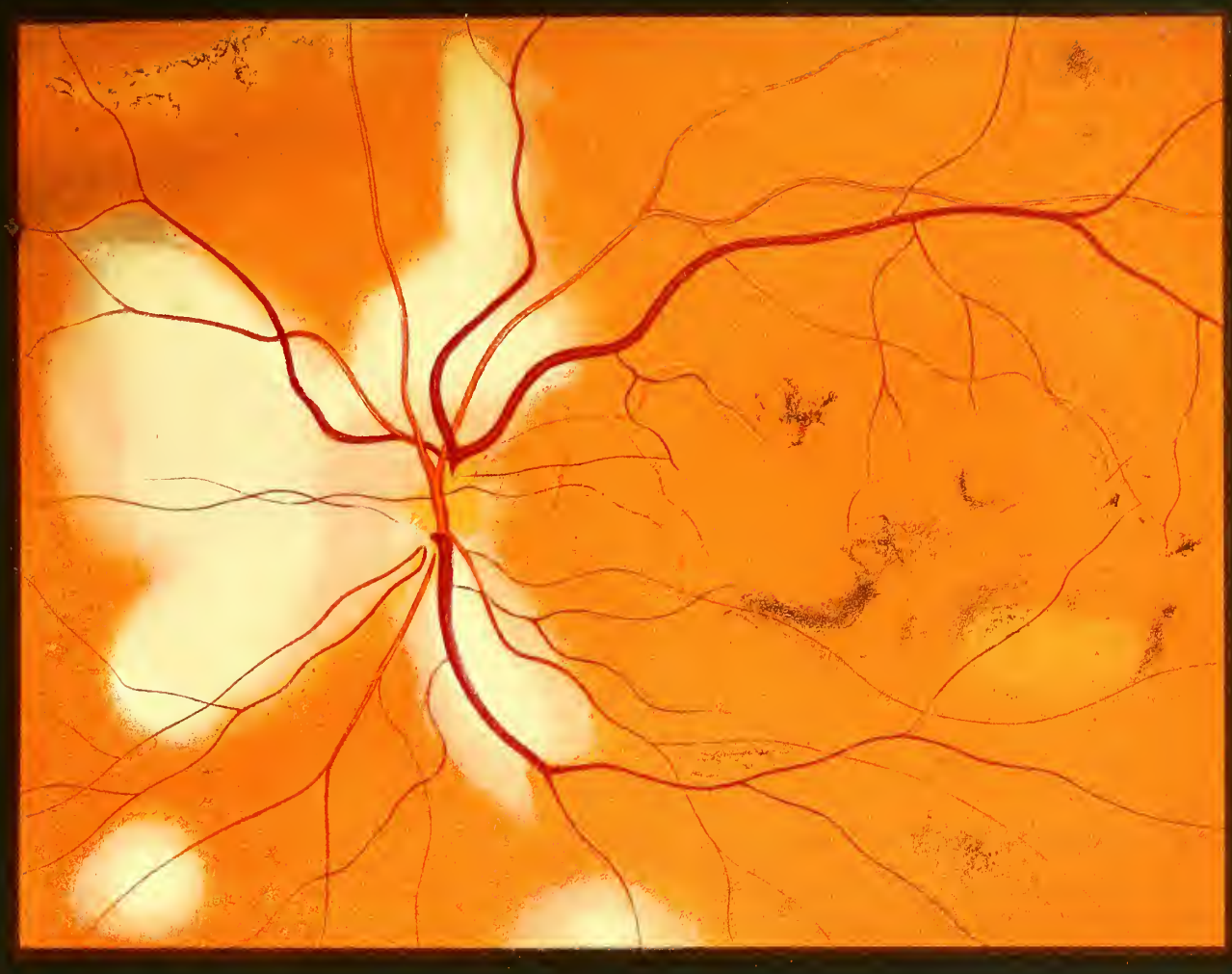

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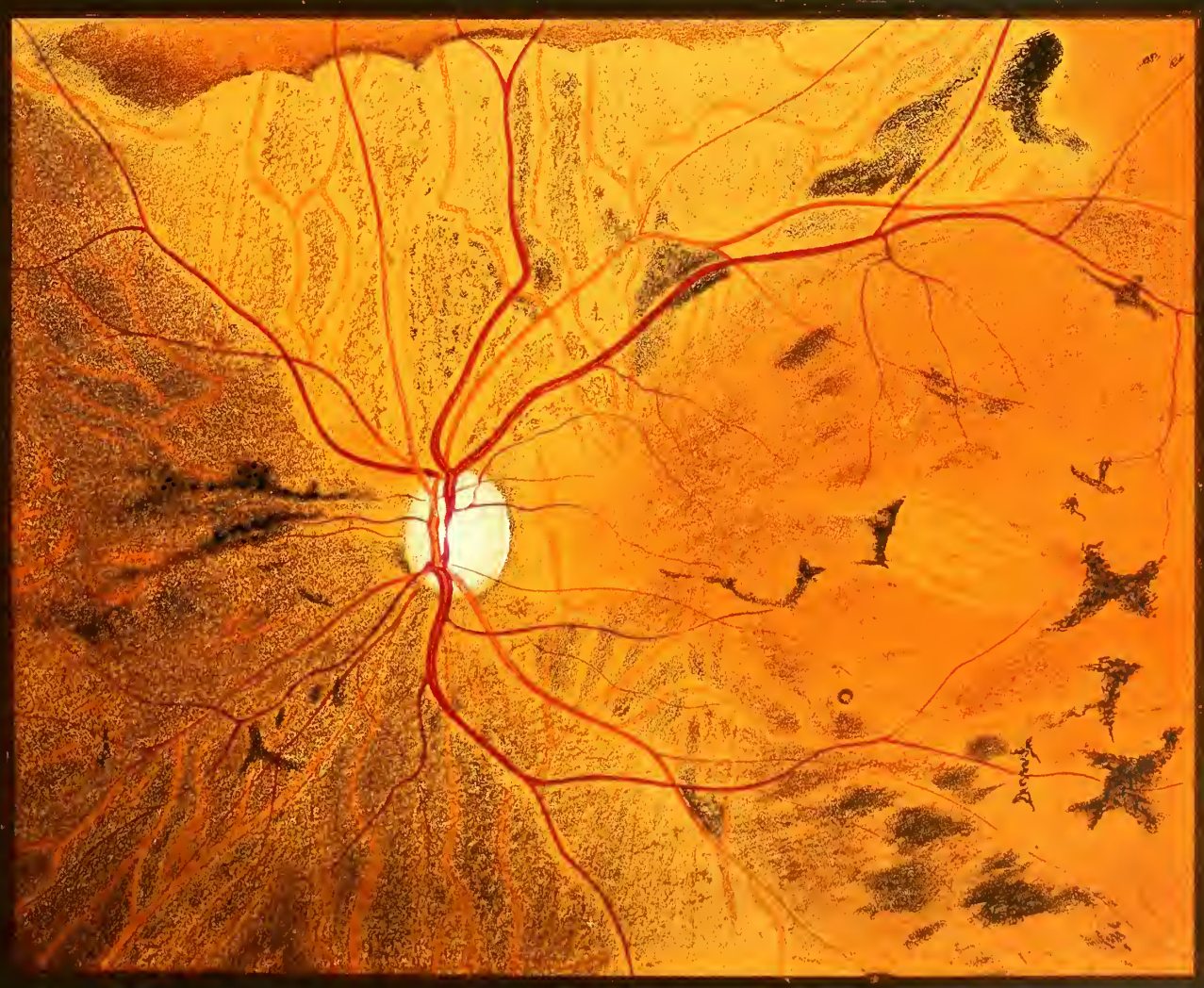

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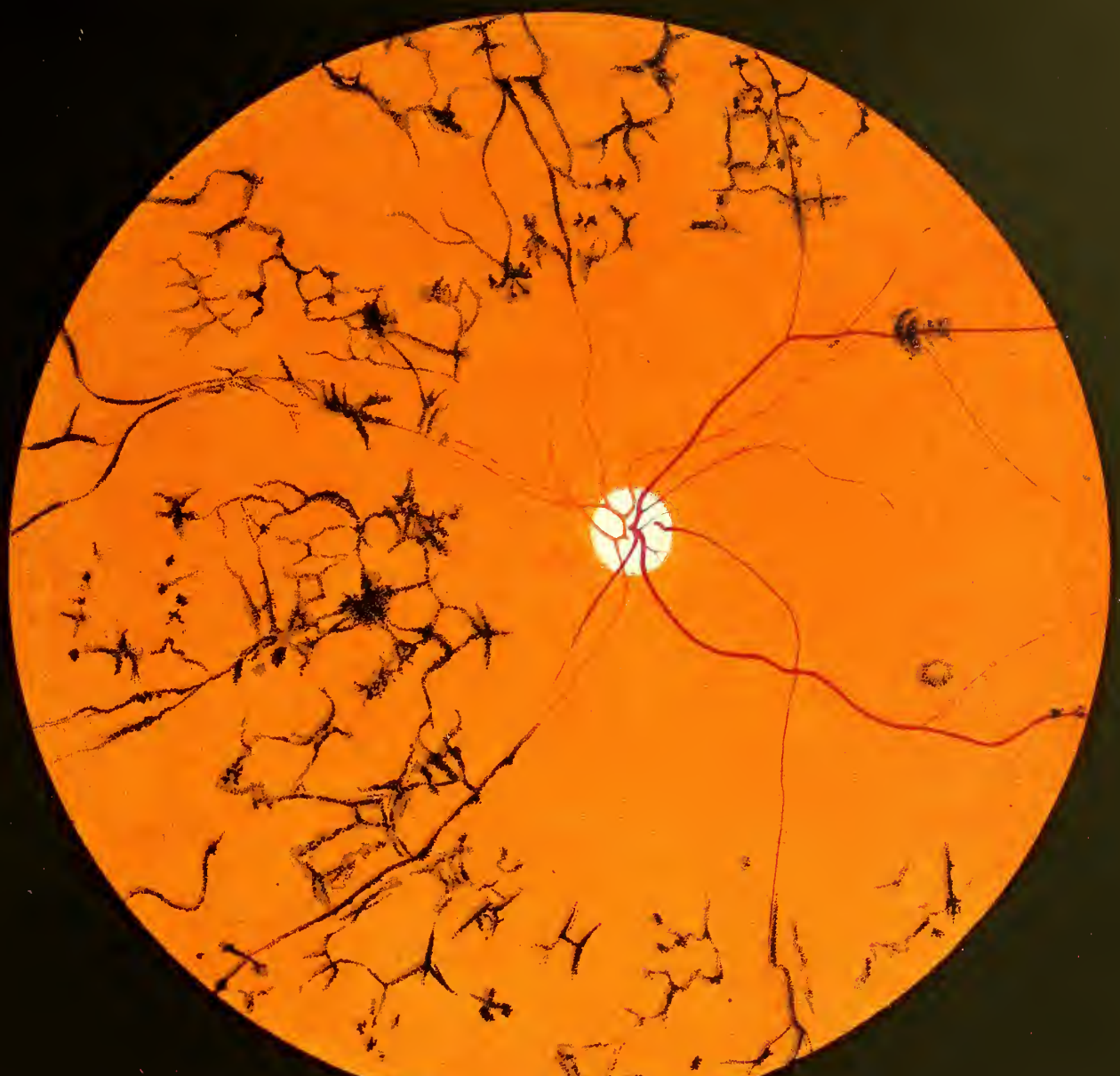

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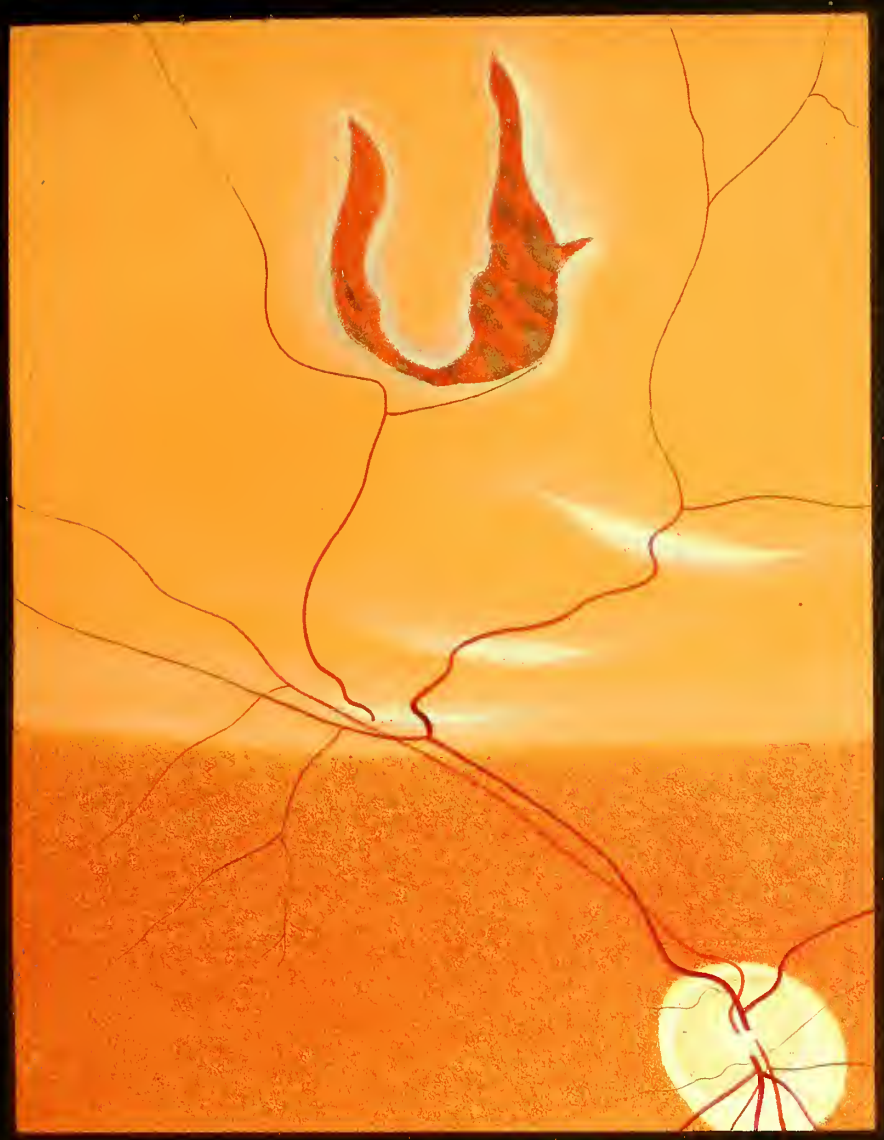

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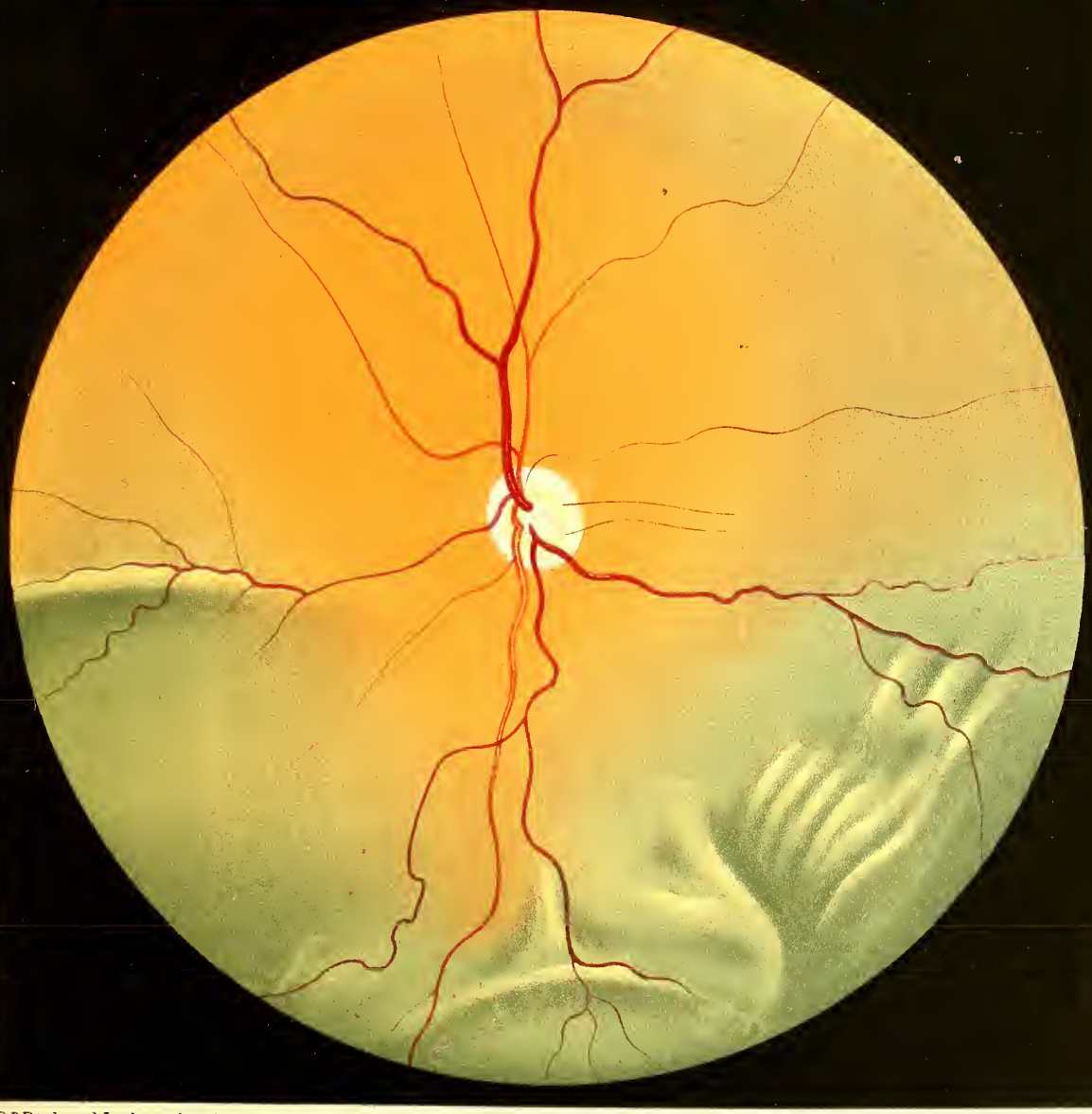

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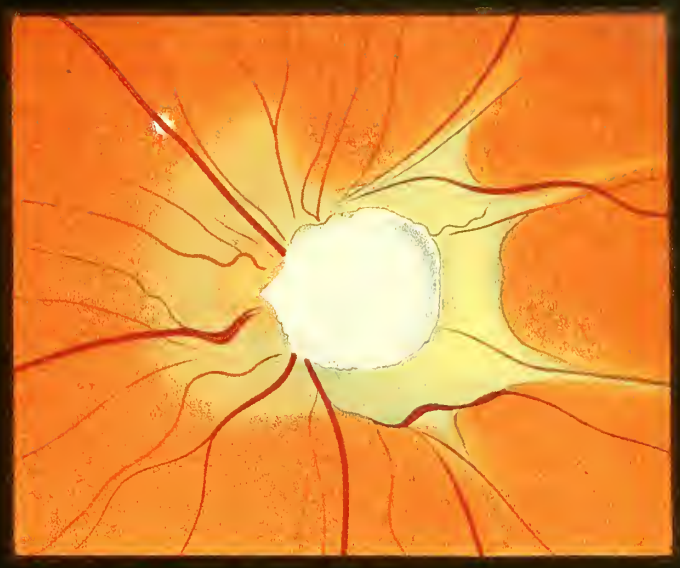

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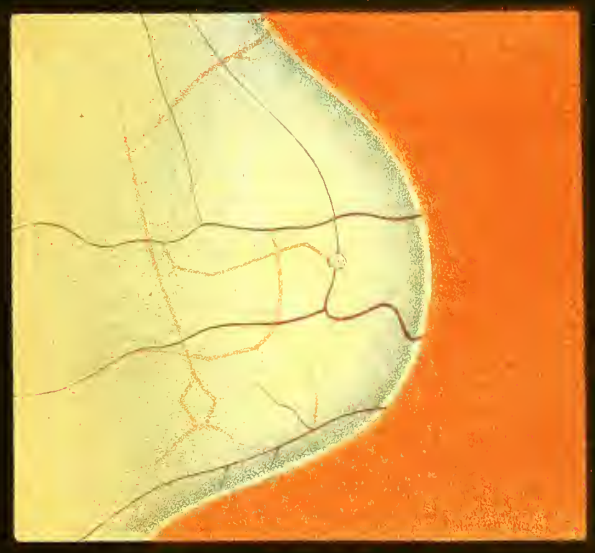

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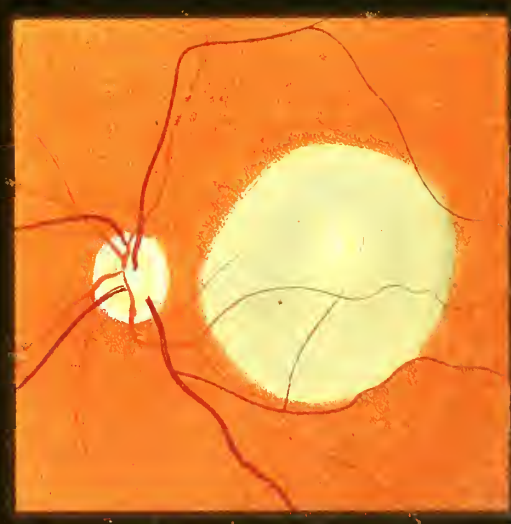

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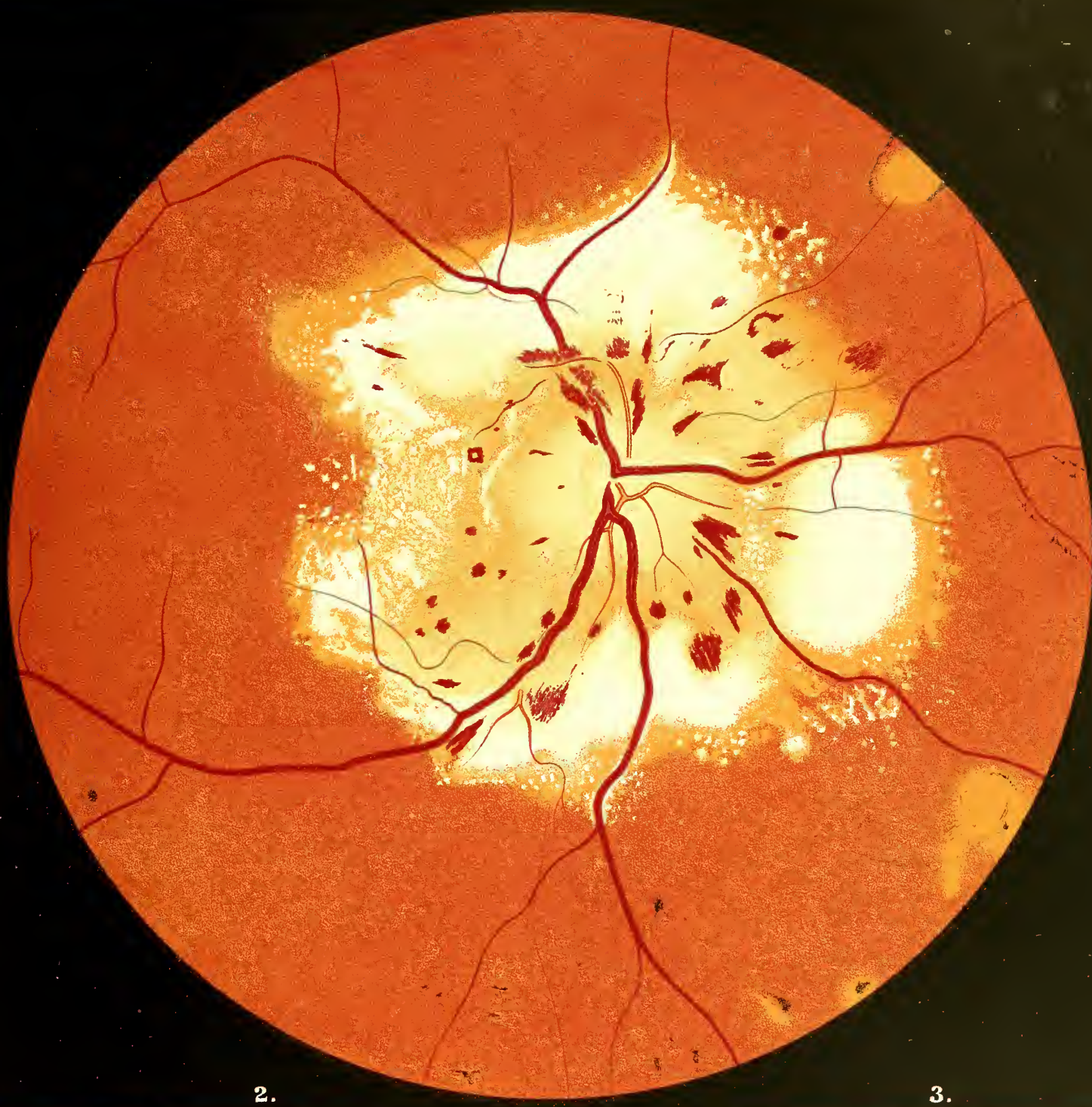

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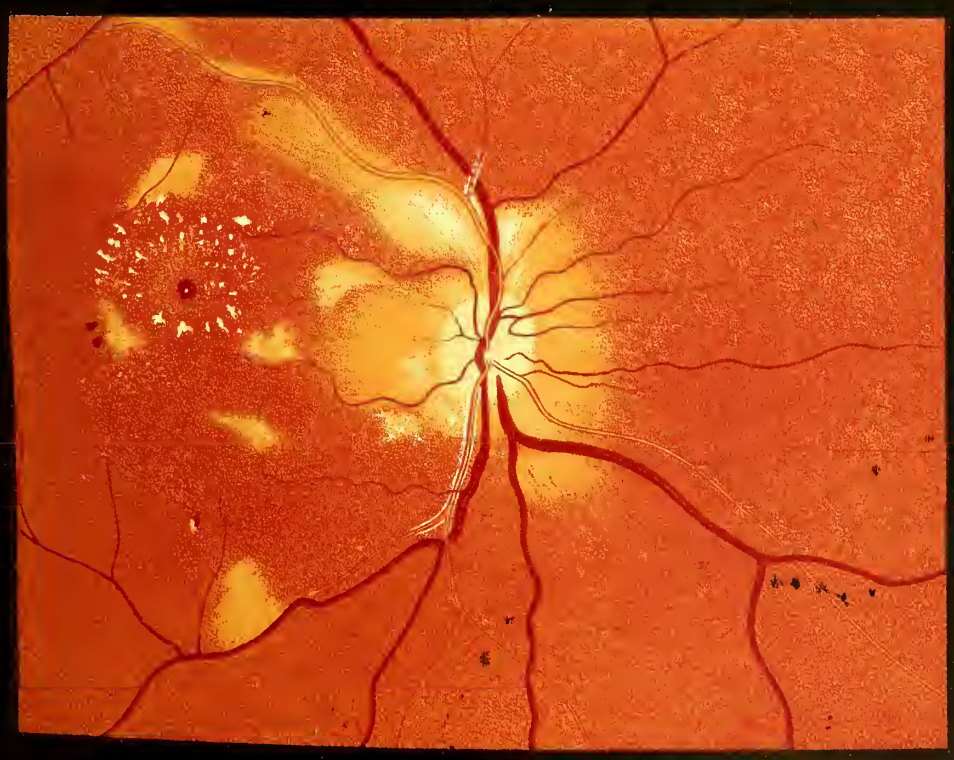

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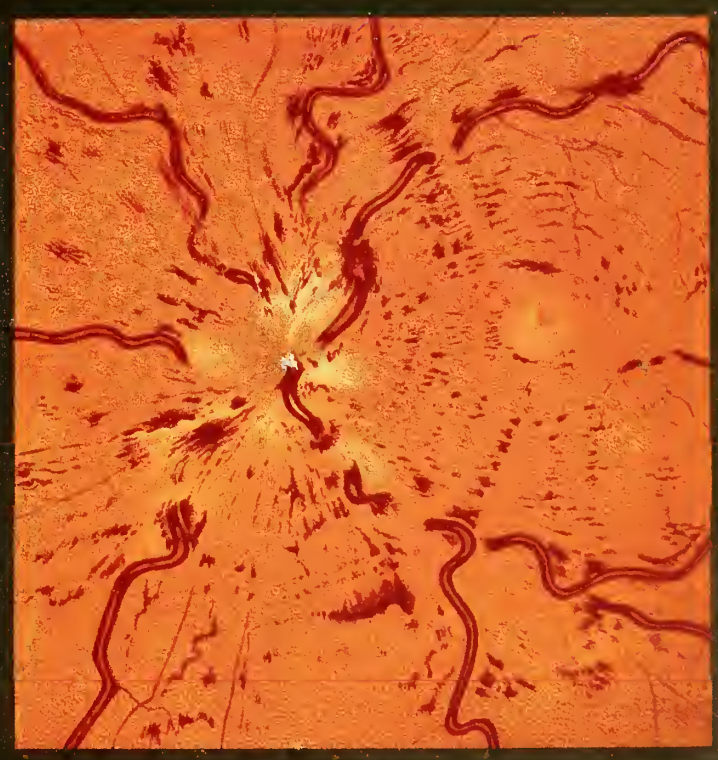

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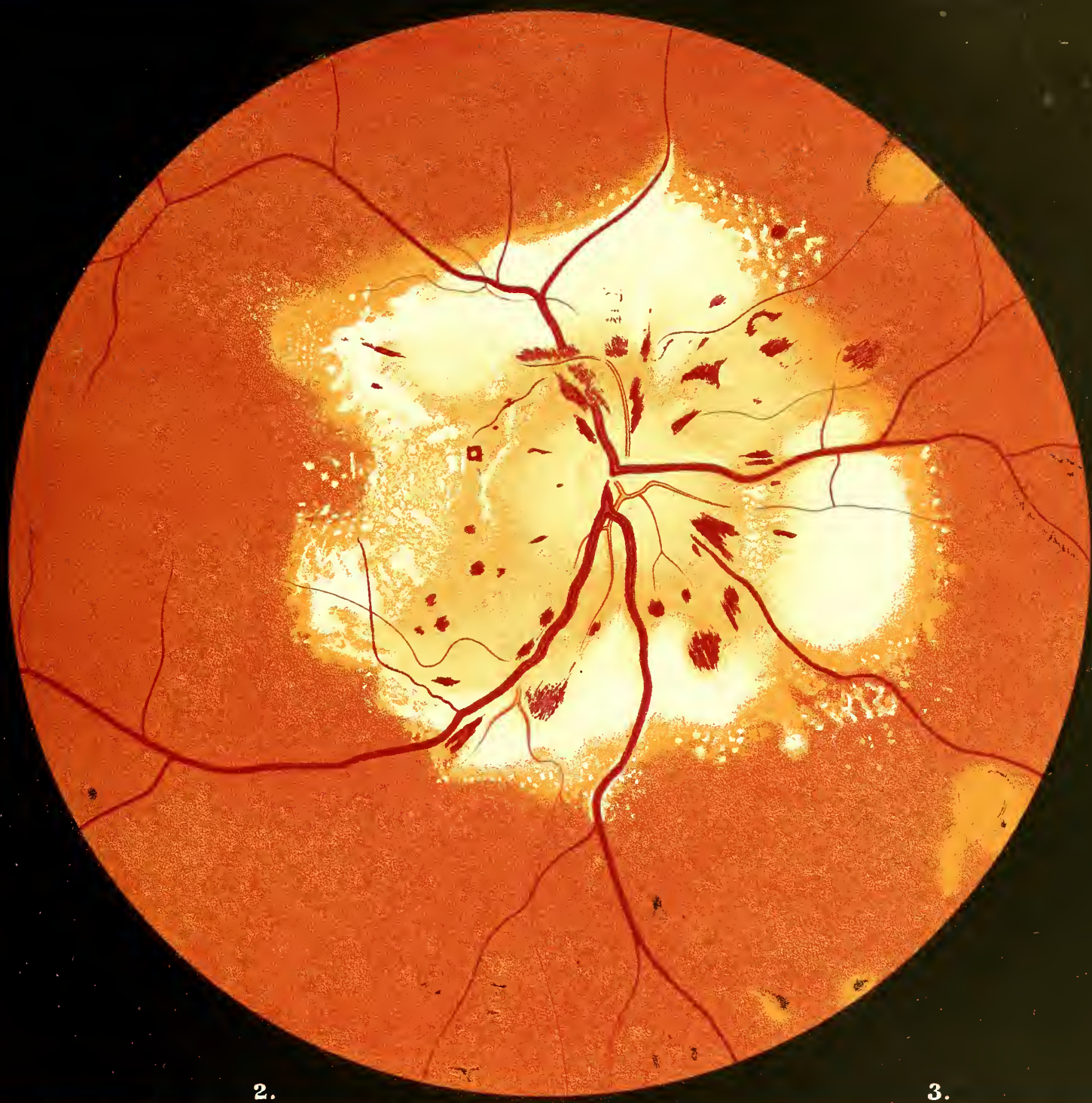

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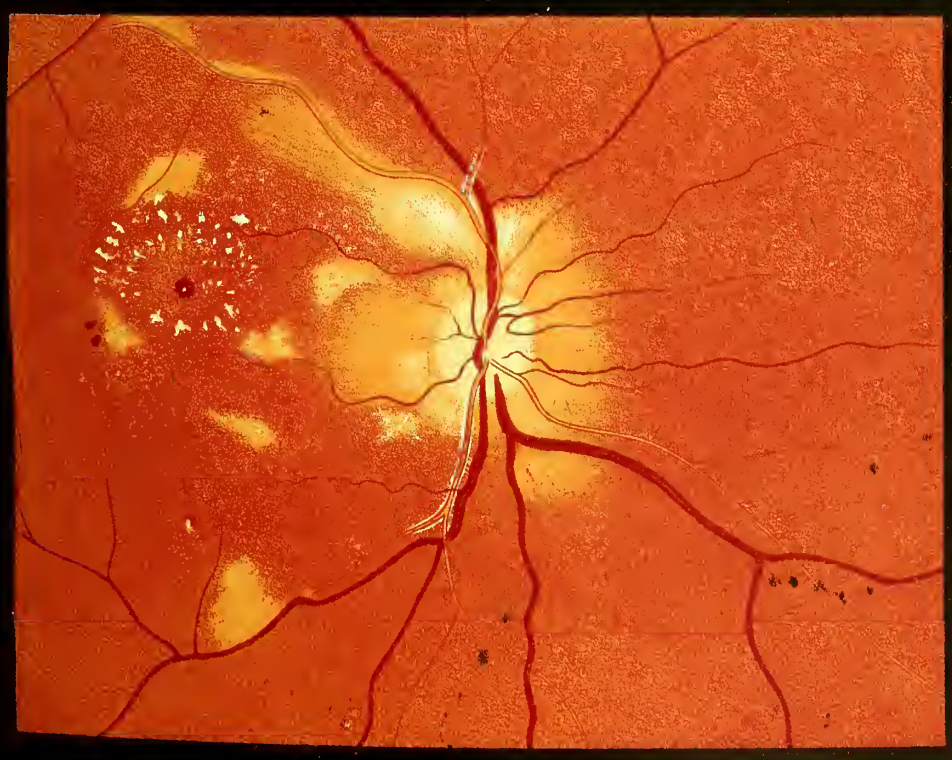

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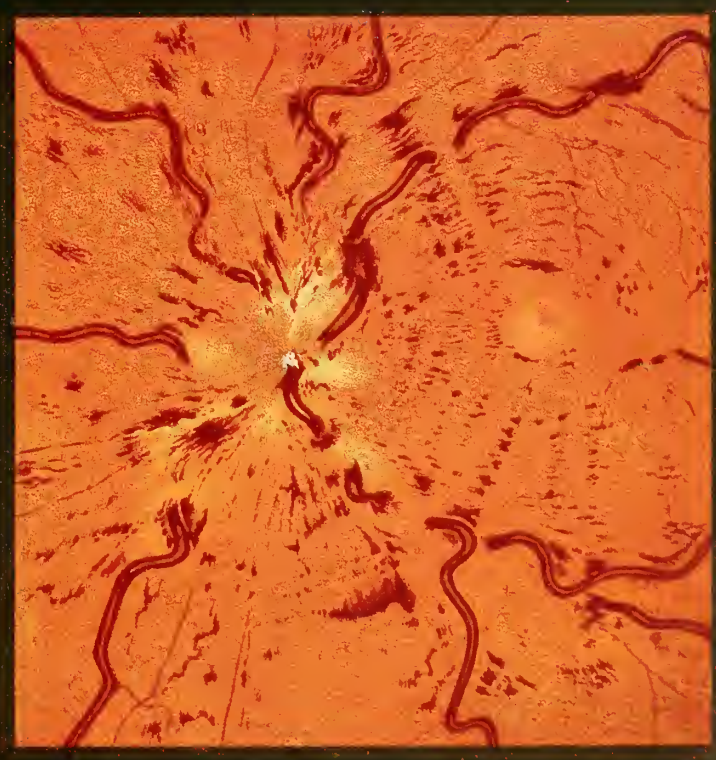

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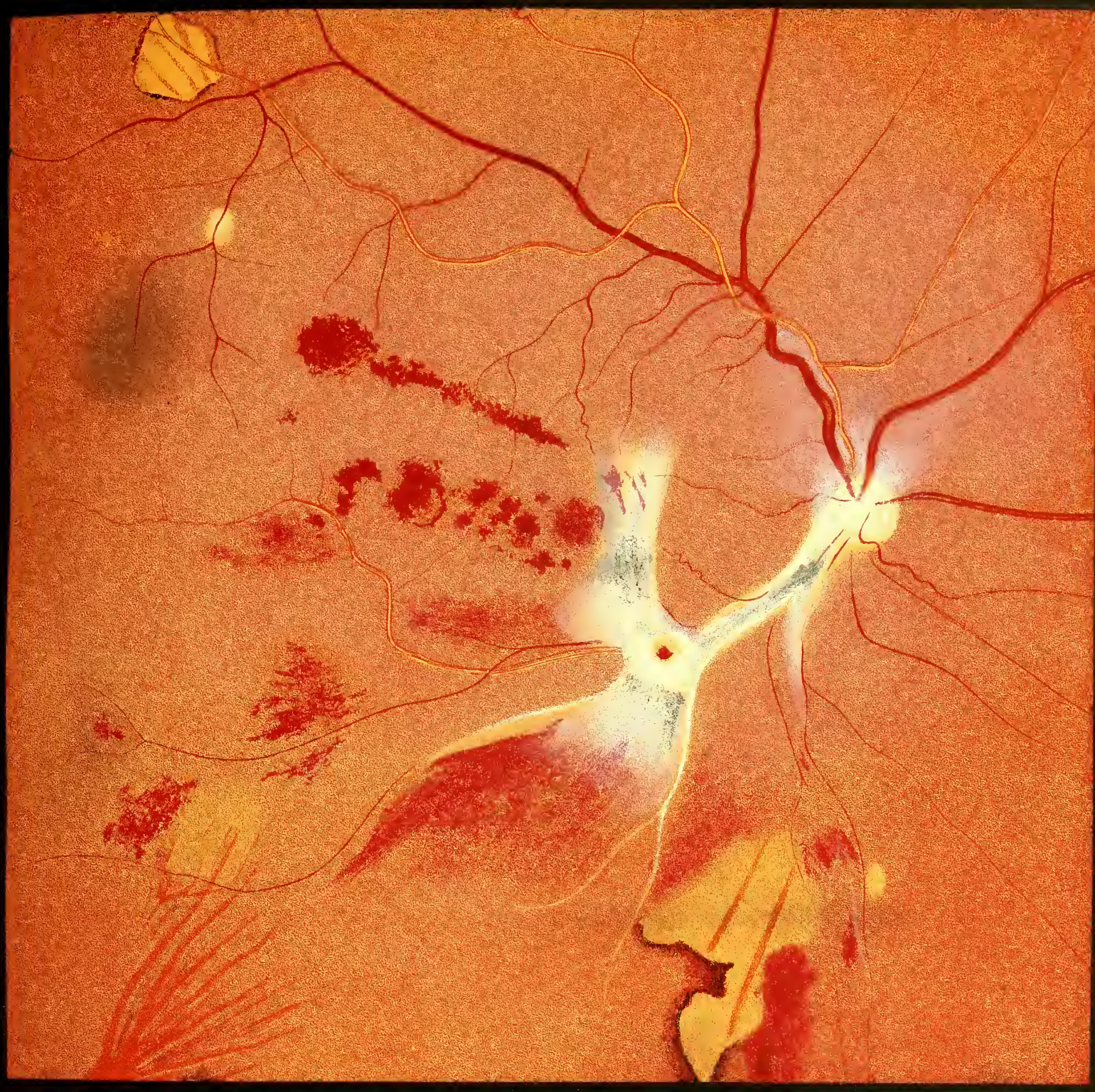

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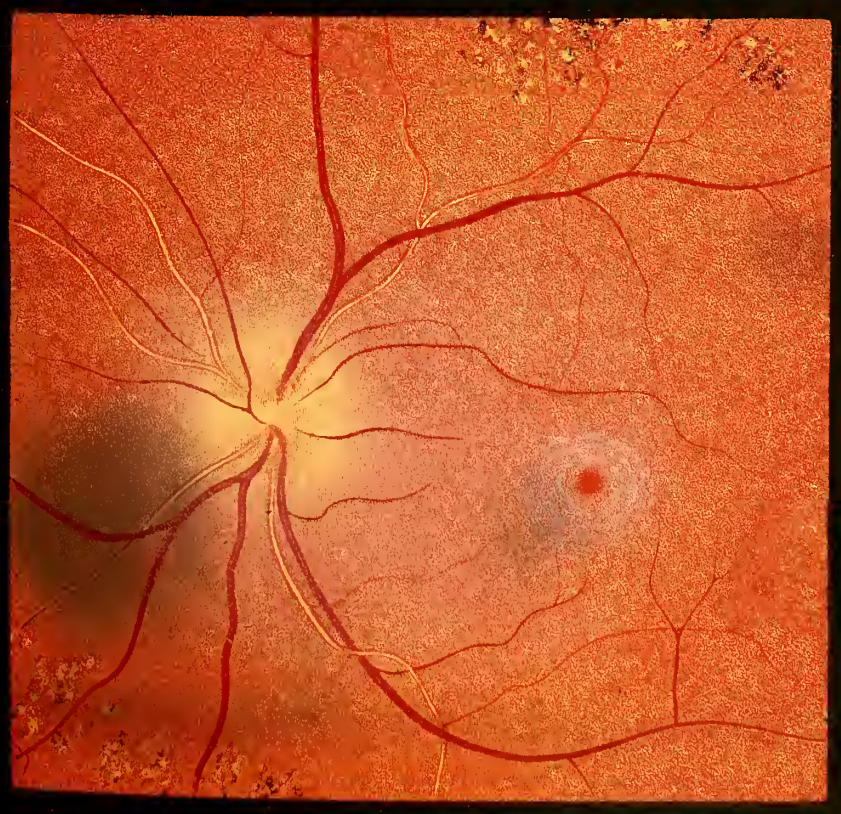

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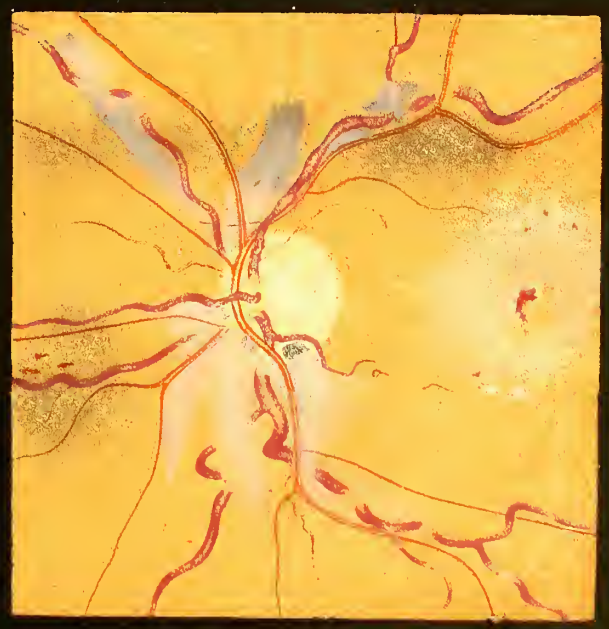

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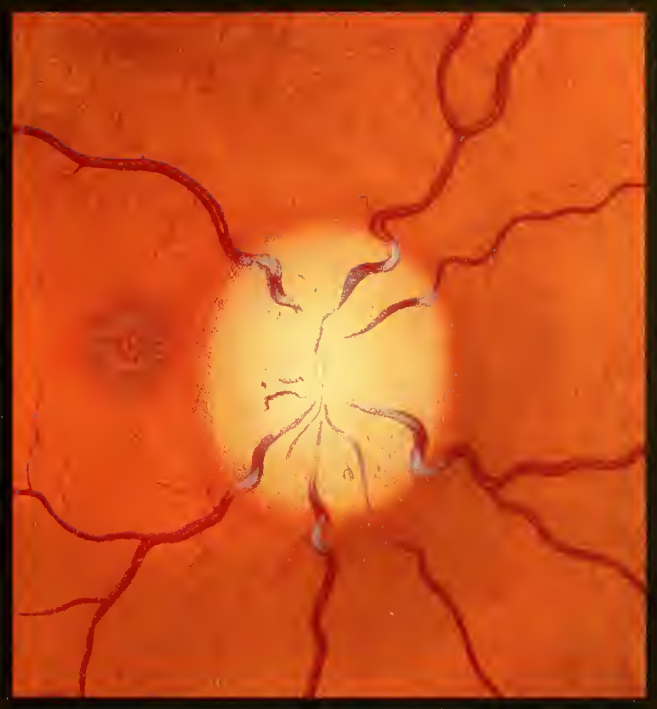

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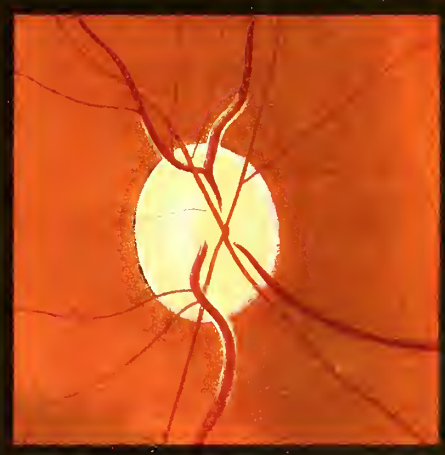

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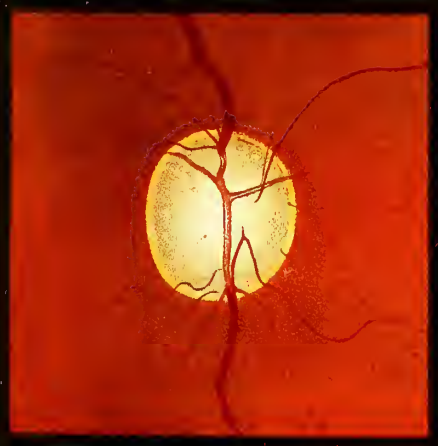

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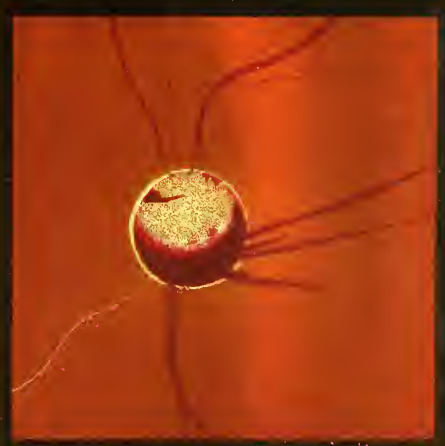

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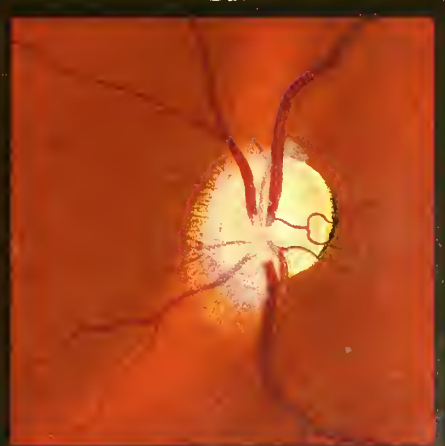

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ATLAS

OF

OPHTHALMOSCOPY.

REPRESENTING

THE NORMAL AND PATHOLOGICAL CONDITIONS

OF THE FUNDUS OCULI AS SEEN WITH THE OPHTHALMOSCOPE.

COMPOSED OF

12 CHROMOLITHOGRAPHIC PLATES, CONTAINING 59 FIGURES,

DRAWN FROM NATURE AND ACCOMPANIED BY AN EXPLANATORY TEXT,

BY

DR. R. LIEBREICH,

THE TEXT TRANSLATED BY H. ROSBOROUGH SWANZY.

SECOND EDITION

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